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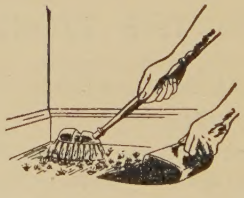

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GAHAN (C. J.). **Furniture Beetles.**—*Econ. Ser. Brit. Mus.* (*Nat. Hist.*) no. 11 4th edn., 26 pp., 1 pl., 10 figs. London, 1946. Price 6*d*.

In this fourth edition, revised and enlarged by F. Laing, of a pamphlet already noticed [*R.A.E.*, A **20** 578, etc.], additional information is given on the influence of wood-decaying fungi on the development of *Xestobium rufovillosum*, Deg. [**30** 269] and the prevention of attack by *Lyctus* by seasoning wood with the bark on it, so as to deplete the starch [*cf.* **20** 454 ; also **32** 289]. Two further treatments for wood, employing boric acid and pentachlorphenol [*cf.* **27** 509 ; **34** 12], are included.

ALIBERT (H.). **Etude sur deux insectes parasites des noix de palme en Afrique Occidentale.**—*Agron. trop.* **1** no. 3–4 pp. 173–176, 4 figs., 1 ref. Nogent-sur-Marne, 1946.

Pachymerus lacerdae, Chevr., was found in nuts of the oil palm, *Elaeis* [*guineënsis*], in Nigeria in 1944 [*R.A.E.*, A **33** 165 ; *cf.* also **35** 90], but investigations carried out at about the same time showed that this Bruchid is apparently not present in French West Africa. On the other hand, fallen nuts collected at Bingerville and Pobé were found to be infested by the Scolytid, *Coccotrypes congonus*, Egg. [*cf.* **15** 211]. The adults of both species are described, and very brief notes are given on their bionomics. The adults of *C. congonus* mine through the shells into the kernels of dry nuts without pericarps ; one kernel may contain several individuals, and pairing and oviposition take place in the galleries. At Pobé, 3·3 per cent. of the fallen nuts collected in a plantation had damaged kernels, and 15·6 per cent. of those in a natural palm grove. A few stored nuts were also found to be infested.

Expérimentation de l'insecticide " D.D.T."—*Agron. trop.* **1** no. 3–4 pp. 182–185. Nogent-sur-Marne, 1946.

F. Bouffil and R. Luziau (pp. 182–183) describe tests with DDT, carried out in Senegal in 1945, against the ground-nut Bruchid [*Pachymerus cassiae*, Gylh.]. Glass jars were prepared on 17th April each containing about 1¼ lb. ground-nut pods previously freed from Bruchids by fumigation with chlorpicrin. In two of these, pure DDT powder was mixed with the pods at the rate of 1 per cent. by weight ; pieces of cotton-wool soaked in a 5 per cent. w/v solution of DDT in kerosene were placed at the bottom of two others, and one was kept as a control. To each of these 15 adult Bruchids were added. A sixth jar contained fumigated ground-nuts only ; the mouths of all the jars were covered with gauze. They were left until 22nd August, by which time two generations of the Bruchid would normally have developed, and counts were then made of the insects present and of damaged pods and seeds. The DDT powder gave practically complete protection, whereas in the two jars containing treated cotton-wool, about one-third of the pods were attacked, and the number of adult Bruchids had increased to 346 and 191, respectively. In the control jar, only seven seeds were undamaged and 1,404 adult Bruchids were found. The seeds in the sixth jar were used as a control in a test of viability, in which the percentages of undamaged seeds from the two jars treated with DDT powder, the two with the treated cotton-wool and the control that germinated after 72 hours were 96, 98, 37, 12 and 94, respectively.

P. Thelu (pp. 183–185) describes field tests of DDT against *Antestia* on coffee in the French Cameroons, carried out during the dry season in December 1945 and January 1946. Plots of 400 trees were used, separated by three rows of trees, and both these rows and the neighbouring plantations were sprayed with a suspension of 1·5 lb. DDT per 100 gals. water to prevent re-infestation of the experimental plots. Five of the latter were sprayed with a proprietary solution

containing 35 per cent. DDT (diluted to give 1·25, 1, 0·75, 0·5 and 0·3 lb. DDT per 100 gals. water, respectively), and five more with a 25 per cent. DDT powder dispersed in water at the same rates. Very few nymphs or adults of *Antestia* were found during the three weeks following treatment on any of the plots treated with DDT at the rate of 0·5 lb. or more per 100 gals ; final-instar nymphs were on the whole more resistant than adults. The lowest concentration gave equally good final mortality but required longer to take effect. Concentrations of 0·3 and 0·5 lb. were also tested under normal field conditions, with similar results. The powder was more convenient in use than the solution, since the solvent employed in the latter injured the rubber parts of the spray apparatus.

DDT was found to have no ovicidal action. Experiments were also carried out in which the trees were sprayed with combinations of DDT and Bordeaux mixture ; the results were in general comparable with those obtained with DDT alone [*cf. R.A.E.*, A **34** 255], whether the Bordeaux mixture was acid or alkaline and whether the spray ingredients were mixed immediately or two hours before use or the Bordeaux mixture was prepared two hours before the addition of the DDT.

SWYNNERTON (R. J. M.). **The Use of Transport and Poison Bait in a Locust Campaign.**—*E. Afr. agric. J.* **11** no. 4 pp. 224–230, 5 refs. Nairobi, 1946.

The author took part in baiting and other operations against the hoppers of the desert locust [*Schistocerca gregaria*, Forsk.] in the Mkomazi Gap, Tanganyika Territory, in May 1944 and here gives notes on the course of the work and much practical advice based on his experience on the organisation and technique of such campaigns. The bait used consisted of coffee husks, sodium arsenite and molasses, with water to moisten. Directions for mixing it are given, as well as notes on the treatment of arsenical poisoning in man and livestock.

Since the hoppers generally feed readily on the bait on descending in the morning from the bushes in which they have passed the night, it should be spread beneath the bushes late at night or early in the mornings. Scattered bands of young hoppers can be concentrated by surrounding them as they settle for the night and driving them into a smaller area, where bait is then spread beneath the bushes. In the case of small and medium-sized migrating bands, the bait is best laid in a strip, three yards wide, round the front and flanks of the advancing band ; if the hoppers are large, the bait should be laid at least 30 yards in front of them. Large bands were dealt with by one or more applications of bait or by combinations of trenches and bait, according to topography. In dense bush, the hoppers generally move along tracks and roads, and the bait should therefore be confined to them ; it should be spread for a distance of 15–20 yards along them, however, as the hoppers are generally dense in such situations. A heavier rate of application is required among succulent grass and crops, and it is advantageous to spread the bait on a strip from which the grass has been removed. In dry sunny weather, bait should be applied only during the cooler periods of the day ; if it has to be spread in the heat, it should be used more thickly and placed in the shade, to prevent it from drying rapidly. Rain washes the poison out of the bait, but mist and drizzle keep it fresh ; dew moistened the bait sufficiently to make it attractive to hoppers for an hour or two each morning for many days after it was laid. The hoppers do not usually show lethal effects for at least 24 hours, and death is often delayed for 72 hours ; surviving hoppers eat those that die, and dying hoppers found 6–8 days after the application of bait were thought to have been poisoned in this way. Hoppers that escape from large bands should not be offered bait a second time for at least 48 hours. Baited bands should be carefully observed, since they are sometimes joined by unbaited ones and the results are thereby obscured.

The subsidiary measures used comprised beating [*R.A.E.*, A **34** 280], digging trenches and the erection of barriers of sheet zinc. Trenches, for which a considerable amount of labour is required, especially if flame-throwers are not available for the destruction of the hoppers that enter them, are of value for the protection of cultivated land against large bands. The sides should overhang, and the soil removed should be deposited on the side farthest from the locusts ; this side of the trench can be lined with zinc sheets if enough are available. As the hoppers enter the trench they must be destroyed by beating, which must be continued throughout daylight or until the band is destroyed ; if it is a large one, the dead hoppers must be removed periodically from the trenches, and this is facilitated by digging sumps in which the hoppers collect, every 50 yards. The hoppers must be prevented from escaping at the ends of the trenches and at gaps left for motor roads. Driving the hoppers into rivers is of little value, as they float across and climb the far bank. If zinc sheets are not available in quantity, they are best utilised by being placed in the path of large bands to form a V or three sides of a square ; deep pits are dug at intervals, just beyond the barrier and preferably at the angles, while the hoppers are being driven up to it. The barriers are then removed and replaced round the edges of the pits with the pegs supporting them on the outside to prevent the hoppers that have fallen in from climbing out. The hoppers are buried when the pits are full. If the bands are small, beating alone is quicker and as effective as the use of zinc barriers.

JANNONE (G.). **Contributi alla conoscenza morfo-biologica e sistematica dell' Ortotterofauna dell'Eritrea. II. Deviazioni dell'istinto materno in** *Schistocerca gregaria* **(Forsk.) ph.** *gregaria* **(Orthop., Acrid.) notate in Eritrea nel 1944.** [Contributions to the morpho-biological and systematic Study of Eritrean Orthoptera. II. Abnormalities in the maternal Instinct in *S. gregaria* ph. *gregaria* observed in Eritrea in 1944.]—*Bol. Soc. ital. Med.* (*Sez. Eritrea*) **5** no. 1–3 pp. 41–54. Asmara, 1945. (With a Summary in English.)

The author describes two cases of abnormal oviposition by *Schistocerca gregaria*, Forsk., ph. *gregaria*, observed in Eritrea in 1944. In the first, some females, instead of depositing egg-pods in soft, loose soil, abandoned their eggs in small rectangular heaps on the pebbles beside the Alighedé river. This was attributed to their having been disturbed by men or cattle passing when they were about to oviposit in the sandy soil of the watercourse. In the second case, egg-pods were deposited in clay or limonitic soils, in isolated places on the Eritrean highlands, where swarms would be unable to develop.

JANNONE (G.). **Contributi alla conoscenza morfo-biologica e sistematica dell'Ortotterofauna dell'Eritrea. III. Nota preventiva sugli Hetrodinae (Orthop., Tettig.) con particolare riguardo alla loro biologia.** [Contributions to the morpho-biological and systematic Study of Eritrean Orthoptera. III. A preliminary Note on the HETRODINAE with particular Reference to their Biology.]—*Bol. Soc. ital. Med.* (*Sez. Eritrea*) **5** no. 1–3 pp. 99–122. Asmara, 1945. (With a Summary in English.)

Records are given of *Eugaster loricatus*, Gerst., and two other Tettigoniids, tentatively identified as *E. aereus*, Sjöst., and *Gymnoproctus abortivus*, Serv., taken in Eritrea in 1944–45, with notes on the bionomics and control of the first two, which are local pests in gardens. Both have one generation a year and are unable to jump or fly. *E. loricatus* occurred from sea-level to an altitude of about 6,200 ft. in wooded but more or less arid land. In the western lowlands, the eggs hatched at the beginning of the rainy season, in June and July, the adults appeared at the end of it, in September, and oviposition took place from

October to December. In the eastern lowlands, where the rainy season is from December to March, the eggs hatched in December, and the adults emerged in March and survived until May or June. The eggs, which were enclosed in special pods, were laid at night in a hollow excavated by the female in soft soil. The loose earth was replaced over them and smoothed down, so that the site of oviposition was scarcely distinguishable. Females oviposited more than once ; 30 egg-pods deposited in rearing cages contained 7–30 eggs apiece.

E. aereus was found in the Eritrean highlands, at altitudes of approximately 6,500–7,600 ft., and its development was not dependent on the rains. The egg stage lasted only 1–2 months ; the nymphs hatched in October–January and became adult in May and June. Nymphs and adults were taken on rocks in arid regions during the dry season, and adults were often observed on trees, bushes and low-growing plants.

In nature, both species fed on vegetable matter and also on small insects and spiders. *E. aereus* sometimes damages strawberries, and *E. loricatus*, in the western lowlands, causes considerable injury to vegetables in gardens, including tomato, egg-plant (*Solanum melongena*) and *S. muricatum*, and also to *Zinnia*. The damage results from injury to the fruit-bearing shoots, as well as from defoliation, and was by both nymphs and adults, though chiefly by the latter. The adults of both species, but particularly *E. loricatus*, also enter the kitchens of dwelling-houses where they devour refuse and scraps of food.

Suggested control measures include the hand-collection of adults and nymphs in gardens at night ; if old sacks are laid on the ground, large numbers shelter beneath them during the day and can be collected and destroyed. The eggs can be killed by spraying the ground near bushes and trees, between February and May, with used motor oil.

HARVEY (W. C.) & HILL (H.). **Insect Pests.**—2nd edn., 7½×5 ins., xi+347 pp., 2 pls., 24 figs. London, H. K. Lewis & Co., Ltd., 1947. Price 14*s*.

Most of the information in this second edition of a work already noticed on insects infesting houses in Britain and their control [*R.A.E.*, A **28** 436] is the same as in the first edition, but some additional insects are dealt with, including beetles that infest woodwork, clothes moths and the carpet beetle (*Anthrenus scrophulariae*, L.). The information on the control of insects infesting foodstuffs is supplemented by data on the prevention of such infestation, and a whole chapter on DDT, with briefer notes on benzene hexachloride, has been added.

Adelges cooleyi, **an Insect Pest of Douglas Fir and Sitka Spruce.**—*Leafl. For. Comm.* no. 2 (revd.), 4 pp., 4 figs. London, 1945.

This revision of a leaflet already noticed [*cf. R.A.E.*, A **9** 376] contains information on the injuries caused to Douglas fir [*Pseudotsuga taxifolia*] and Sitka spruce [*Picea sitchensis*] in Great Britain by *Chermes* (*Adelges*) *cooleyi*, Gill. [*cf.* **23** 157] and on its control. On Douglas fir, severe attacks are usually confined to the type known in America as the green or coastal type, and only the needles are affected, though the rate of growth is probably reduced. Plantations suffer their heaviest attacks up to the " thicket " stage. Infestation is usually most intense about the middle of the tree and on the inner parts of the branches, but leaders and outer terminal shoots are sometimes heavily attacked ; severe mottling of the needles occurs in spring and summer. On Sitka spruce the galls produced by the Aphid cause distortion and, if attack is severe, cessation of growth of affected shoots. Galls are also produced on other species of spruce, but not Norway spruce [*Picea abies*].

The most important natural enemies of *C. cooleyi* are adults and larvae of the Coccinellids, *Aphidecta obliterata*, L., and *Exochomus quadripustulatus*, L., which mostly attack the eggs. Control can be obtained in nurseries, gardens

and young plantations by spraying with a 3 per cent. Lysol solution, an emulsion of 2 pints kerosene, 1 lb. soft soap, and 10 gals. water or a spray of $\frac{3}{4}$–1 fl. oz. 98 per cent nicotine, $\frac{1}{2}$ lb. soft soap and about 10 gals. water. Treatment should be carried out in early spring, when the insects are most vulnerable, and the spray should be concentrated on the under sides of the needles. Severely infested seedlings and transplants in the nursery can be dipped in the Lysol solution.

Chafer Beetles.—*Leafl. For. Comm.* no. 17 (revd.), 11 pp., 4 figs. London, 1946.

It is stated in this revision of a leaflet already noticed [*R.A.E.*, A **16** 238] that the larvae of five species of Lamellicorns are injurious to the roots of seedlings and young trees in forest nurseries in Britain. They are *Melolontha melolontha*, L., *Serica brunnea*, L., *Amphimallon* (*Amphimallus*) *solstitiale*, L., *Anomala* (*Phyllopertha*) *horticola*, L., and *A. dubia* var. *aenea*, Deg. Characters are given distinguishing the larvae and adults, together with notes on their bionomics and local distribution. *Melolontha* is the most important economically and is dealt with in greater detail than the others. The life-cycle of *Melolontha* lasts four years, of *Amphimallon* usually two but sometimes three years, of *Serica* two years, of *Anomala dubia* var. *aenea* probably two years, and of *A. horticola* one year. First-year conifer seedlings that have their tap-root severed usually die outright, especially in dry weather, but transplants of broad-leaved trees sometimes survive severe gnawing, girdling and even severance of their roots, provided that this occurs in wet cool weather; if they produce fresh rootlets above the damaged part, a high proportion may recover from the attack. Other insects that cause superficially similar but less serious damage are cutworms (*Agrotis*), wireworms and Hepialid larvae.

The control measures recommended are cultivation of the soil between May and September to expose or kill the feeding larvae or the pupae, for which a suitable rotation of nursery cropping is necessary, hand-collection of larvae so exposed, the encouragement of insectivorous birds, and fumigation of the soil with carbon bisulphide. The larvae of *Melolontha* are parasitised by the Tachinid, *Dexia rustica*, F., but little control is afforded.

Potter (C.) & Perkins (J. F.). **Control of Brassica Pests by DDT.**—*Agriculture* **53** no. 3 pp. 109–113, 1 ref. London, 1946.

DDT was tested for the control of pests of cruciferous crops in England during 1944 and 1945. A dust of 5 per cent. DDT in kaolin applied to brussels sprouts on 18th July 1944 gave complete control of *Mamestra brassicae*, L., and, until 3rd August, of *Pieris rapae*, L., and reduced the numbers of *Plutella maculipennis*, Curt. The treatment was applied when the females were ovipositing actively, but did not prevent oviposition, and by 29th August the tops of the plants showed considerable damage by *Pieris rapae*. Plants that had received a second application on 17th August were free from larvae on 29th, and the earlier damage sustained by them was almost unnoticeable. Treatment on 17th August alone gave complete control of *M. brassicae* and almost complete control of *P. rapae*, and considerably reduced damage. In 1945, part of a field of mixed crucifers on which there were few caterpillars was dusted with DDT on 10th August; on 1st September, no living larvae were present and no damage had occurred since the treatment, whereas some of the control plants were defoliated by larvae of *Pieris brassicae*, L., which were almost fully fed. Complete control of *P. brassicae*, *P. rapae* and *Mesographe* (*Pionea*) *forficalis*, L., and a great reduction in numbers of *Mamestra brassicae* were given in two days when the dust was applied on 28th August to heavily infested kale.

Plots of winter cabbage were treated on 5th July, when a few larvae of *Pieris brassicae* and *P. rapae* and large numbers of adults of *Plutella maculipennis* were present with a spray containing 0·2 per cent. (w/v) DDT in suspension. No caterpillars were found on 63 treated plants on 18th July, but 99, mostly *P. maculipennis*, but including some *M. brassicae* and *Pieris rapae*, were found on 59 untreated ones ; of 359 sprayed and 354 unsprayed plants examined on 11th September, 12 and 62, respectively, were damaged. Neither the spray nor the dust had any significant effect on infestation by *Brevicoryne brassicae*, L. ; numerous dead Hymenopterous parasites, including many of the genus *Aphidius*, and some dead Coccinellids were found in the treated plots, but Syrphid larvae survived the treatments.

Spraying and dusting trials were carried out in 1944 on crops severely damaged by adults of *Phaedon cochleariae*, F., which migrated to them from a watercress bed that dried up owing to drought. Cabbages and radishes over a small area sprayed with 0·2 per cent. DDT on 1st August were free from infestation three and six days later, whereas the control plants were heavily infested ; since the beetles had left the controls by 14th August, no further assessment of the treatment could be made. An area of brussels sprouts and cabbages was treated on 1st August with a dust containing 5 per cent. DDT in a mixture of silica and kieselguhr (1 : 4 by weight), which gave a high degree of control and protection ; the percentage of plants attacked by 7th August was 5, as compared with 47 in the controls, and the attacked plants were also less heavily infested than in the controls.

Evidence was obtained in 1945 that 5 per cent. DDT in kaolin is effective against *Meligethes aeneus*, F., attacking flowering crucifers and gives good protection for seven days ; there was some indication of toxicity to bees, but this did not interfere with seed production. *Ceuthorrhynchus assimilis*, Payk., did not appear to be affected.

Small-scale trials against insects on other crops were also made in both years. The 5 per cent. dust gave promising results against *Sitona* sp. on tick beans [*Vicia faba*], weevils, woodlice and earwigs [*Forficula auricularia*, L.] on clover, *Aphis sambuci*, L., on elder, and larvae of *Hyponomeuta cognatellus*, Hb., on ornamental *Euonymus*, but had little effect on *A. fabae*, Scop., on tick beans or *Eulecanium* (*Lecanium*) *corni*, Bch., on flowering currant. A spray containing 0·1 per cent (w/v) DDT was also of little value against *A. fabae* on tick beans, and one containing 0·2 per cent. DDT was ineffective against *Tetranychus telarius*, L., on peach in a glasshouse.

Colorado Beetle in England in 1945.—*Agriculture* **53** no. 3 pp. 129–133, 1 map. London, 1946.

The records of the Colorado beetle [*Leptinotarsa decemlineata*, Say] in England during 1945 are reviewed, and an account is given of the measures adopted to prevent its introduction and establishment there [*cf. R.A.E.*, A **34** 161]. Beetles were found on several boats arriving at south-coast ports from France during May, and a survey of their prevalence in northern France showed that potatoes were heavily infested in some areas and indicated the ports at which the beetles were most likely to gain access to the boats. During May and the first part of June, when occasional beetles were found more frequently on the boats, single beetles were reported in gardens, at three places near ports. No potatoes were growing in the gardens and crops nearby were not infested. Between 16th July and 14th August, adults were found on potatoes in two allotments at Faversham, Kent, and in five fields within a few miles of them, and pupae and an egg cluster were also present in one of the fields. The outbreaks were all small and may possibly have been derived from a colony that remained undetected in 1944 ; all stages have generally been present in August, but unusually warm weather in May 1945 may have caused early

oviposition by over-wintered adults. Isolated adults were found on 25th July and 2nd August in two fields near Deal and near Ramsgate from which early potatoes had been lifted, but there was no evidence that larvae or adults had been feeding ; 30–40 larvae were discovered on 2nd August in a potato field near Worthing, Sussex, in which pupae were later found when the crops were lifted, and a beetle and a larva were taken on 24th August while potatoes were being lifted in a large field near Gloucester. The measures adopted were those employed in previous years, and chiefly comprised careful examinations of surrounding crops, hand-collection of the beetles and immature stages, and, in some cases, the injection of carbon bisulphide into the soil of infested areas, with or without the application of arsenical sprays to neighbouring crops.

GRISON (P.). **Remarques sur des phénomènes de diapause vraie observés au stade imaginal chez le doryphore** (*Leptinotarsa decemlineata* **Say**).—*C. R. Acad. Sci.* **218** pp. 342–344, 5 refs. Paris, 1944.

It is usually thought that the seasonal periods of inactivity in adults of *Leptinotarsa decemlineata*, Say, are caused by hot and dry conditions in summer and by cold in autumn. In the valley of the Creuse, however, first-generation females enter the soil in August, about three weeks after emergence, without ovipositing, while overwintered females that appear in April–May are still able to lay many eggs [*R.A.E.*, A **33** 158]. The author considers that this entry into the soil before oviposition marks a physiological resting stage occurring independently of external conditions and under optimum conditions for activity, and presents evidence to support this view. Successive generations were reared on young potato shoots in the laboratory and out of doors between April and September 1943. Out of doors, eight pairs of adults gave rise to 64 first-generation females, of which 41 did not oviposit, and a second generation all of which were inactive. In the laboratory nine pairs of adults gave rise to three generations ; 98 of 133 first-generation females, 42 of 44 second-generation females, and all of seven third-generation females failed to oviposit. In another experiment, a thousand newly emerged first-generation adults collected at Versailles on 6th July were placed in a large out-door cage containing abundant food ; by 27th July, about 820 had entered the soil and the females that were still active had begun to oviposit. The diapause lasts 4–6 months whether the beetles are kept at constant optimum conditions or first subjected to cold. In the laboratory, resumption of activity following normal cessation of diapause was observed to occur from the end of November 1943 up to March 1944 ; when adults that were not ready to resume activity were removed from the soil and placed under optimum conditions in a damp greenhouse at 25°C. [77°F.], they immediately re-entered the soil. From an examination of the gonads it was found that the reproductive function ceases during diapause. It appears that external factors do not break the diapause, but merely induce a resumption of activity after it is over ; if they do not attain their lower thresholds of effectiveness, the resting stage is further prolonged by a period of false diapause. It is possible that the occurrence of diapause in individuals is determined by genetic factors and that the populations under observation were heterogeneous for this character. The author concludes that the diapause of *L. decemlineata* is obligatory and that, although it may not take place in individuals of every generation, it always appears in a succession of two or three generations under the climatic conditions of France.

BONNEMAISON (L.). **Sur une maladie à virus du framboisier et son mode de transmission.**—*C. R. Acad. Agric. Fr.* **30** no. 12 pp. 294–296, 6 refs. Paris, 1944.

On 30th March 1938, symptoms of a virus disease of raspberries were observed in a small plantation in the Rhône department of France on plants of a native

variety that had appeared healthy two days before. The terminal leaves of infected canes were less than a third the size of normal leaves, their edges were curled and irregular, and yellow patches developed on the leaf blades; from 5th May onwards, small reddish-brown necrotic areas appeared between the veins of the older leaves. During June, heavily infected stools frequently produced canes with apparently normal foliage, but a faint yellow coloration along the veins in some of them was followed by incipient necrosis. On 20th June, typical symptoms suddenly appeared on canes that had hitherto appeared healthy. Leaves that appeared to be normal were also produced between 9th and 21st July. In August, the infected stools were readily distinguished by their dwarf habit and shrivelled leaves, the partial yellowing of the foliage, the numerous small, basal shoots, and the almost complete loss of fertility. These characters were more marked in 1939, when few flowers were produced and 20 per cent. of the infected canes dried up by the end of August.

In transmission experiments in which the upper and lower surfaces of young leaves on ten healthy plants were lightly rubbed with juice from infected leaves on 8th April, the foliage on eight stools showed slight discoloration on 17th April, and by 19th had begun to shrivel. When apterous and alate individuals of *Aphis idaei*, v. d. Goot, which is common on raspberry, were transferred from infected to healthy stools, symptoms appeared on the latter in 40–45 days. The disease to some extent resembles leaf-curl and mosaic diseases that attack raspberry in the United States, but is not considered to be identical with any of these. The symptoms observed in France are probably caused by a complex comprising at least two viruses, of which *A. idaei* probably transmits one or both.

All the stools in the plantation under observation were destroyed in the autumn of 1939, whether infected or not; another plantation was made on the same site, and this was found to be quite healthy in August 1943. The destruction of all canes within a radius of about 330 ft. of an infected area is therefore recommended against this disease.

CAIRASCHI (E. A.). **Observations sur les facteurs de pullulation des pucerons-vecteurs de maladies à virus de la pomme de terre.**—*C. R. Acad. Agric. Fr.* **30** no. 12 pp. 314–316, 2 refs. Paris, 1944. **La pullulation des pucerons-vecteurs de maladies à virus de la pomme de terre en 1943. Quelques observations et conséquences pratiques en rapport avec la sélection sanitaire.**—*T. c.* pp. 316–317, 3 refs.

In view of the importance of Aphids as vectors of virus diseases that cause degeneration of potatoes, the influence of climatic factors on their multiplication was studied in France in an attempt to determine the conditions favourable for raising virus-free potatoes for planting. The first paper contains the results of observations in 1943 on the abundance of Aphids on potatoes of the same variety in different parts of France made by counting the Aphids present on 100 mature leaves taken from average plants every ten days, beginning three weeks after the shoots appeared above ground, and by keeping the populations on individual plants under continuous observation. Maximum populations were recorded at the end of June in the Mediterranean region, at the beginning of July near Paris, and at the end of August in mountainous regions at altitudes of about 2,600–3,300 ft. Infestation was slight or absent in Brittany, moderate near Paris and heaviest in certain mountain districts. By correlating the meteorological data with the population curves, it was found that the latter showed a definite rise when the mean temperature was 18°C. [64·4°F.] and the relative humidity below 75 per cent. [*cf. R.A.E.*, A **23** 492]. It is concluded that humidity was the main factor governing abundance in 1943, which was an unusually dry year. Optimum humidity and high populations occurred only in certain areas, including the mountains, which are generally too wet to provide favourable conditions.

In the second paper, the bearings of these results on the selection of localities in France for the raising of virus-free stock are discussed. It is pointed out that regional differences in the date at which maximum Aphid populations are produced are responsible for differences in the extent to which early and late varieties become infected with virus disease. Early varieties mature 8–15 days before the period of maximum reproduction is reached in mountainous localities, and satisfactory results can be expected from crops planted at the end of May, when the risk of late spring frosts is less. In the specialised climate of the Alpes-Maritimes, healthy stock can be obtained from tubers of early varieties planted in coastal and exposed situations at altitudes of about 650–1,300 ft. at the end of August and harvested in November. Reproduction by Aphids is especially marked during the period of active vegetative growth that follows flowering, and since their numbers remain high until the tubers are mature, the danger of infection increases until harvest. The early destruction of the haulms is therefore desirable as a precautionary measure against virus diseases.

Bouchet (R.). **Nouveau procédé de lutte chimique contre l'anthonome du pommier** (*Anthonomus pomorum* **L.**).—*C. R. Acad. Agric. Fr.* **30** no. 14 pp. 349–353. Paris, 1944.

As sulphides of polychlorcyclane, which are derivatives of benzene hexachloride, showed marked insecticidal properties when tested against *Leptinotarsa decemlineata*, Say, a spray containing a proprietary mixture (Braconyl) of these sulphides and glycerides of aliphatic acids was tested in the spring of 1944 against *Anthonomus pomorum*, L., in an apple orchard in north-western France. The trees were sprayed on 11th April, when the buds were breaking (green-tip stage), and some were sprayed again on 18th April (green-bud stage). Counts in two plots on 9th May showed that there were 0·33 and 5·9 per cent. capped blossoms on trees that received one application, and 11·7 and 0·33 per cent. on those that received two, as compared with 50 and 55·8 per cent. for no treatment ; the percentages of control were thus 99·3, 89·4, 76·6 and 99·7, respectively. On an earlier variety that received a single application on 8th April at the green-bud stage, when oviposition had already taken place, the percentage of capped flowers was reduced from 59·8 to 5·6 (90·6 per cent. control). These results indicate that the spray must have had considerable ovicidal action, as well as affecting the adults. It did not injure the trees to which it was applied, but these flowered 4–5 days earlier than the controls ; this is an advantage, since rapid flowering hinders the development of the larvae. The strong insecticidal action of the mixture is attributed to synergism between the sulphides of polychlorcyclane and the glycerides. Because of its ovicidal properties, the spray can be applied over a considerable period and should therefore be of value in large orchards. It should be applied at high pressure and is most likely to give satisfactory results at the green-tip stage, when the weevils are mating ; the treatment should be completed in not more than seven days. Should plant growth and oviposition be retarded by cold weather, few flowers be produced, or the numbers of overwintered weevils be large, applications should be made, the first at the green-tip stage and the second 7–8 days later.

[Chugunin (Ya. V.) & Yuganova (O. N.).] **Чугунин (Я. В.) и Юганова (О. Н.). Phenological Calendar for the Protection of Orchards from Pests and Diseases.** [*In Russian.*]—2nd revd. edn., 272 pp., 124 figs. Simferopol', Kruimizdat, 1946. Price 6 *rub.*

This is a revised and enlarged edition of a handbook on the protection of fruit trees in the Crimea from insects and fungi, the first part of which has already been noticed [*R.A.E.*, A **23** 488]. The first part (pp. 9–143) deals with apple and pear, and the number of insect pests included is increased to 21. Its

general plan is unaltered. The second (pp. 147–202) deals similarly with the phenology, pests and diseases of apricot, peach, plum and cherry, specific information being given on ten important insect pests, with a section on control measures applicable to peach and apricot at different times of the year. In the third part (pp. 205–253), the preparation and use of various fungicides and insecticides (including DDT dusts and sprays) are discussed, and separate chapters are devoted to the organisation and technique of spraying from aeroplanes, spraying and dusting from the ground, and spraying with oil emulsions prepared with local types of clay.

A programme of control measures is appended, arranged in tabular form according to the seasonal development of the trees, showing the measures to be applied, the pest or disease against which they are directed, and the material to be used, with concentrations and rates of application.

Wilson (H. B.). **Termites (White Ants) and their Control.**—*J. Dep. Agric. Vict.* **44** pt. 6 pp. 261–268, 9 figs. Melbourne, 1946.

An account is given of the habits of the subterranean termites that attack structural timbers in Victoria and of methods of preventing infestation of buildings by them. These include the use of metal barriers [*cf. R.A.E.*, A **31** 30] and treating the bases of wooden posts to a height of 12 ins. and the soil surrounding them with creosote oil. Termites cannot enter a building constructed on a concrete slab the projecting edges of which are kept clean. All joints in the concrete should be treated with creosote and the superstructures fastened to it without posts that pierce it and enter the soil. Soil treatment round the slab is optional. Measures recommended for the control of termites in buildings that have not been protected comprise treating the soil and the posts that enter it with creosote or blowing white arsenic powder into the termite galleries in the timber [*cf.* **30** 103], though this does not prevent re-infestation. Two methods of rendering round timber resistant to termite attack, and also to decay, by immersion in heated creosote, are described.

Gay (F. J.). **A Case of House Infestation by a Tree-dwelling Colony of *Coptotermes frenchi* Hill.**—*J. Coun. sci. industr. Res. Aust.* **19** no. 4 pp. 330–334, 1 fig., 2 refs. Melbourne, 1946.

An account is given of severe damage caused to the wooden flooring of part of a house near Canberra by *Coptotermes frenchi*, Hill, reported in April 1946. The infestation was confined to a brick section constructed in 1937 with no precautions against termites. The joists and bearers of the floor, which were made of local ash (almost certainly *Eucalyptus fastigata*), had been almost entirely destroyed, but the floor itself, made of cypress pine (*Callitris glauca*), had not been damaged, although the termites had made extensive contact with the underside and constructed several runways over it. A few puffs of finely powdered white arsenic were blown into each of about 24 runways discovered. Examination of the surroundings showed no old stumps or logs in the vicinity, but the nest was found low down in the trunk of a recently dead stringy bark tree (*Eucalyptus macrorrhyncha*), 72 ft. from the north-east corner of the house, and a gallery was found extending along a root some 30 ft. towards the house and continuing in the soil. The depth of the gallery was 2–2½ ft. for a distance of 60 ft., and it passed under the foundation wall of the house at a depth of 2¾ ft. The nest contained large numbers of recently dead termites, which were producing moist decaying patches in the central region, and no eggs or young, and it is concluded that this condition was due to the action of the arsenic injected into the runways. Other galleries were found radiating from it. The depth of the underground gallery investigated indicated that the commonly recommended treatment of applying such materials as arsenicals or creosote, to the top 12–18 ins. of soil is of little value as a barrier outside houses, though

treatment of the soil inside the walls and round floor piers and dwarf walls, through which the termites had to pass to enter the house, may be useful.

Greaves (T.) & Rochford (R. R.). **Observations on the relative Susceptibility of Potato Varieties to Attack by the Rutherglen Bug** (*Nysius vinitor* **Berg.**).—*J. Coun. sci. industr. Res. Aust.* **19** no. 4 pp. 387–393, 1 fig., 1 ref. Melbourne, 1946.

The indigenous Lygaeid, *Nysius vinitor*, Bergr., frequently attacks potato and other crops in temperate and sub-tropical Australia, causing serious loss in seasons when strong spring growth is followed by dry weather. This occurred in December 1945, and visible rating on 25th January 1946 of the damage caused to 58 varieties of potato in an irrigated experimental crop near Canberra showed that some were more seriously affected than others. Varieties recognised as synonyms showed a similar degree of susceptibility. In general, the late varieties were much less affected than the early and mid-season ones, and some varieties that had strong stems yielded quite good crops in spite of serious damage to the haulms, whereas weak plants gave very small crops. A significant reduction in yield was associated with intensity of damage. In the most heavily attacked varieties, both leaves and growing points were damaged, but most of those that were only lightly attacked had leaf damage only, though some showed tip damage only, some leaf and tip damage on only part of the plant, usually the upper shoots, and some general, but slight damage.

Comparison of the results from this experimental plot with those from an unirrigated field trial in New South Wales showed several outstanding anomalies, which suggests that varieties may differ in relative susceptibility to damage with change of environment.

Smith (J. H.). **Pests of the Peanut Crop.**—*Qd agric. J.* **62** pt. 6 pp. 345–353, 5 figs. Brisbane, 1946.

The pests of ground-nuts in Queensland include *Penthaleus major*, Dugès, which has attacked them in the South Burnett district since 1942. Outbreaks of this mite usually occur during spring and early summer and are less serious when rains stimulate rapid growth of the crop. Chlorosis of the leaves is followed, if the mites are numerous, by a decline in the rate of growth and by a shedding of the lower leaves ; should the attack last for several weeks, some of the young plants may die. Infestation usually begins on small groups of plants, and then spreads rapidly throughout the field. The eggs are laid on the upper surface of the leaves, and the immature and adult mites feed on the leaves, usually during the late afternoon. If control is required, two applications at an interval of ten days of a dust containing 3 per cent. nicotine would probably prove effective.

Ground-nuts grown on friable, volcanic, red soils are liable to attack by Lamellicorn larvae, especially in newly cultivated grassland. The larvae sever the stems 1–3 ins. below ground level, and plants that have developed normally for some weeks collapse and die between November and February. The species involved vary in different districts, but all have similar life-histories ; *Rhopaea magnicornis*, Blkb., is of importance in southern Queensland. The life-cycle occupies two years ; the adults are in flight between November and January, and the eggs, which are laid in the soil, hatch in three weeks. The larvae complete their development in about 16 months and pupate in earthen cells deep in the soil. Since oviposition is slight in fallow land or land carrying very young plants, the larvae are rarely troublesome in fields planted to annual crops each year. Ground-nuts and other cultivated plants are sometimes killed by adults of the Dynastid, *Trissodon* (*Isodon*) *puncticollis*, Macl., which feed 2–3 ins. below ground level and sever the stems from the roots ; the larvae are not injurious to plants.

Serious damage is occasionally caused to ground-nuts by larvae boring in the crown. They resemble those of the Lamiids, *Zygrita diva*, Thoms. [*cf. R.A.E.*, A **35** 272] and *Sybra centurio*, Pasc., but have not so far been reared to the adult stage. The only practicable method of control consists in burning crop residues after harvesting.

Larvae of *Heliothis armigera*, Hb., burrow into the tip of the plant, causing the growing point to collapse, and also injure the stem and flowers. The attacks usually occur when the crop is 8–10 weeks old and the first-formed nuts are filling out, but they seldom last more than three weeks, and if growing conditions are good the crops make a rapid recovery. The eggs are laid singly on the foliage, and the life-cycle may be completed in four weeks in summer [*cf. loc. cit.*]. Weeds on which the insect breeds should be eliminated, and ground-nuts should be planted as far as possible from the chief food-plants, especially maize, lucerne and cotton. The presence of a spring crop of maize often determines the abundance of *H. armigera* in January and February, when ground-nuts are growing freely.

Adults and nymphs of the Pentatomid, *Nezara viridula*, L., feed on the upper part of the stem, causing the collapse of the terminals, and this stimulates the development of axillary buds so that the subsequent growth is somewhat bunched, but yield not much affected. The eggs are laid on the under-surface of the leaves, and there may be several generations during the year. Control measures have not been required on ground-nuts, possibly owing, in part, to the activity of the introduced egg parasite, *Microphanurus basalis*, Woll., but if they should prove necessary, a spray containing 0·2 per cent. DDT, applied when migration to the crop has been completed, should give control.

Plants near the bottom of poorly drained slopes are sometimes infested by *Pseudococcus* sp., as a result of which they become stunted and show little response to summer rains. The mealybugs cluster in dense colonies on the underground parts of the plants or, occasionally, round the base of the stalk. They are particularly numerous on the nuts, which often collapse and turn black. Since some species of ants feed on the secretions of the mealybugs and spread infestation by carrying the crawlers from plant to plant, ground-nuts should be planted on well-drained soils, in which ants are less numerous.

Minor pests that rarely cause damage of economic importance to ground-nuts are *Monolepta australis*, Jac. (*rosea*, Blkb.), adults of which occasionally invade restricted areas of the crop in dense swarms and feed on the foliage, and *Heteronyx brevicollis*, Blkb., which causes similar damage, although the swarming habit is less characteristic and foliage injury is more evenly distributed throughout the field ; large numbers of adults of *H. brevicollis* may be seen in flight in some districts between November and January.

ZECK (E. H.). **Weevils associated with the Bud-fall of** *Eucalyptus sideroxylon*.—*Agric. Gaz. N.S.W.* **57** pt. 6 pp. 312–313, 1 fig., 3 refs. Sydney, 1946.

Severe bud-fall of *Eucalyptus sideroxylon*, and consequent loss of acres of flowers of value in honey production, has recently been caused in western districts of New South Wales by weevils identified as *Haplonyx longipilosus*, Lea, *H. spencei*, Gylh., and *Oxyops gemella*, Pasc. Fallen buds showed an oviposition puncture near the base. The adults of the three species are briefly described, and notes are given from the literature on the bionomics of two other species of *Haplonyx* [*cf. R.A.E.*, A **12** 569 ; **21** 265].

LLOYD (N. C.). **Hilling to control Potato Moth. Good Results obtained with Disc Hiller at Guyra.**—*Agric. Gaz. N.S.W.* **57** pt. 8 pp. 401–404, 5 figs. Sydney, 1946.

Hilling the soil against potato plants has long been recognised as of value in protecting the tubers from infestation by *Gnorimoschema operculella*, Zell., in

Australia [*cf. R.A.E.*, A **33** 186], but it is often neglected owing to the unsatisfactory results given by the implements commonly used or is ineffective because it is done too early, before formation of the tuber-bearing laterals is complete. In an experiment in New South Wales in 1945–46, when rainfall was above average, hilling with disks attached to a tractor 71 days after planting (as soon as the tuber-bearing laterals had formed) or 26 days later reduced the percentage of the crop infested (by weight) to 3·7 and 3·5, respectively, as compared with 15·2 in unhilled plants and 10·2 and 13·3, respectively, in plants hilled on the same dates by the " scuffler " method commonly used. It is thought that the later date of hilling would have been relatively more effective in a dry season, when the soil would crack more, and that, as there was no significant reduction in yield owing to mechanical damage by the tractor, the new type of hilling implement is very promising.

WASON (E. J.). **D.D.T. as a Codling Moth Control. Experiments with Apples on Murrumbidgee Irrigation Area.**—*Agric. Gaz. N.S.W.* **57** pt. 8 pp. 427–431, 3 figs., 1 graph. Sydney, 1946.

An account is given of an experiment carried out in New South Wales in 1945–46 to compare the efficiency of DDT with that of the standard lead-arsenate treatment in controlling the codling moth [*Cydia pomonella*, L.] on apple and to observe its effect on other pests. Peak emergence of the overwintered and first generations of the moth occurred in the first week of November and between 11th and 18th December and a partial second generation emerged between 19th February and 3rd April. A calyx spray and five cover sprays were applied, on 20th and 30th October, 12th November, 4th and 21st December and 10th January, respectively, to three randomised blocks of trees, and a fourth block was left untreated. The spray programmes tested were 0·1 per cent. DDT as an emulsified solution in solvent naphtha ; 3 lb. lead arsenate per 100 gals. with 1 lb. calcium caseinate in the calyx spray, 1 gal. white oil in the first three cover sprays and 1 quart white oil in the last two ; and the same with the substitution of the DDT spray for lead arsenate and oil in the second and fourth covers. The apples were picked in late January 1946. The percentages of uninjured fruits on trees that had received the three treatments were 98·6, 95·7 and 97·2, respectively, as compared with 44·9 on the controls. No sign of spray injury to fruit or foliage was observed on trees to which DDT had been applied, and the general appearance of the fruit at harvest compared favourably with that of fruit from unsprayed trees. All trees that had been sprayed throughout the season with DDT became heavily infested by a species of *Tetranychus* (*Eotetranychus*), however, and it caused marked damage to the foliage, resulting in early leaf-drop, whereas unsprayed trees and those sprayed with lead arsenate and white oil remained free from the mite. Trees that received two sprays of DDT became highly infested. *Eriosoma lanigerum*, Hsm., was present on most of the trees at the beginning of the season, but its parasite, *Aphelinus mali*, Hald., had been active during the winter and exerted marked control. The Aphid did not increase on trees that did not receive DDT, but increased slightly in March on trees that received two DDT sprays and considerably from early December to April on those that received the full DDT programme. Examination of the colonies on these trees in April failed to reveal the presence of the parasite. No trace of *Quadraspidiotus perniciosus*, Comst., was observed on any of the harvested fruits, but as the trees had received a dormant oil spray late in the winter for the control of this Coccid, it could not be known whether DDT had any effect on it.

It is concluded that although DDT was most effective against *C. pomonella*, it did not prove superior to the standard treatment of lead arsenate and white oil, and its use is complicated by the increase in the populations of *Tetranychus*

and *Eriosoma* that follow it. These pests might be controlled by the addition of special ingredients to DDT, but this would increase the already high costs of the treatment.

STEINER (L. F.), SUMMERLAND (S. A.) & FAHEY (J. E.). **Experiments in 1945 with DDT for Control of the Codling Moth.**—24 pp., 2 refs. [Washington, D.C.] U.S. Dep. Agric., Bur. Ent. [1946.]

The study of DDT for the control of the codling moth [*Cydia pomonella*, L.] on apple was continued in 1945 in Indiana [*cf. R.A.E.*, A **35** 81] and in Kentucky, in both experimental plots and commercial orchards. The weather was cold and wet, and thus unfavourable to *C. pomonella*, which was more effectively controlled on the same plots with seven cover sprays in 1945 than with ten in 1944. Proprietary preparations containing 25 per cent. DDT were used in most of the tests.

The results of tests in Indiana involving 46 plots containing apples of three varieties are shown in a table. The trees were about 26 years old and each received seven cover sprays at the rate of 25–35 U.S. gals. per application. The sprays were applied from a tower and from the ground and from the inside as well as the outside of the tree. All spray quantities are per 100 U.S. gals. On Rome Beauty, the percentages of uninjured apples and (in brackets) the numbers of larvae per 100 apples were 98 (0·7), 98 (1·3), 98 (1·4) and 98 (1·8), respectively, for sprays consisting essentially of full-strength DDT (1 lb. in the first six sprays and 12 oz. in the seventh) supplemented with 1 U.S. quart oil, 6 oz. DDT in combination with lead arsenate against the first generation and at full strength thereafter, full-strength DDT alone, a mixture of 6 oz. DDT, ½ U.S. pint nicotine sulphate, 2½ lb. Wyoming bentonite and 1 U.S. quart soy-bean oil, as compared with 90 (6·6) for a standard lead-arsenate schedule and 91 (8·3) for one of 1 U.S. pint nicotine sulphate and 8 lb. Mississippi bentonite.

On the Turley variety, the corresponding figures were 98 (0·9), 98 (1·1), 98 (1·8), 96 (2·7) and 95 (3·8), respectively, for 6 oz. DDT with lead arsenate against the first generation and with nicotine sulphate and Mississippi bentonite thereafter, 6 oz. DDT with lead arsenate throughout, full-strength micronised DDT in pyrophyllite, full-strength DDT alone, and 6 oz. DDT with nicotine sulphate and bentonite, as compared with 83 (11·8) for standard lead arsenate and 89 (9·9) for nicotine sulphate and bentonite. On Ben Davis, moth migration into the plots after the harvesting of neighbouring orchards offset the effect of nicotine and DDT on the moth population; but treatments including DDT again proved superior to the standard schedules. The best control (96 per cent. uninjured fruit and 0·4 larvae per 100 apples) was obtained with an emulsified solution of full-strength DDT in 1½ U.S. pints benzene and 1 U.S. quart soy-bean oil with 8 oz. Wyoming bentonite, which was more effective than full-strength commercial DDT with or without Bordeaux mixture, and rather more so than full-strength DDT with Bancroft clay or in the form of a water paste with soy-bean oil and bentonite or soy-bean flour.

In a comparison of DDT dusts, ten applications were made at an average rate of 2·5 lb. per tree. The percentages of injured fruits and (in brackets) the numbers of larvae per 100 apples were 62 (52·5) for a dust containing 5 per cent. DDT with walnut-shell flour or dinitro-o-cresol dust on Jonathan apples, as compared with 91 (5·7) for a standard schedule of seven cover sprays of nicotine sulphate and bentonite, and 33 (113) for a dust of 5 per cent. DDT with 0·6 per cent. rotenone and 1·2 per cent. nicotine in tobacco dust on Ben Davis, as compared with 75 (24) for 11 applications of the nicotine-bentonite spray. Under the rainy conditions of 1945, the dust deposits were effective only immediately after application.

In the large-scale tests in Indiana, the sprays were applied with stationary equipment to about half the trees in each programme and with a high-volume air-blast sprayer to the remainder. The results were based on examinations of several varieties. All trees received calyx and calyx top-off sprays of lead arsenate and sulphur between 12th and 21st April. Four cover spray programmes were tested, consisting essentially of nicotine sulphate and bentonite, DDT, DDT with nicotine sulphate and bentonite, and DDT with lead arsenate against the first generation and without it thereafter. Oil was added to most of the sprays. The number and timing of the treatments were accommodated to the control obtained, and ten applications of the first two schedules, seven of the third and nine of the fourth were made. At the end of August, the percentages of uninjured fruits and the numbers of larvae per 100 apples were 91·3–93·1 and 2·7–3·9, respectively, for the last three schedules and 80·4 and 15·6 for the first. There was little subsequent increase in infestation except on trees treated with the air-blast sprayer, which was used on the outside of the trees only and gave poor coverage of the inner surface of the apples, thus permitting increased survival of first- and second-generation larvae so that a substantial third-generation attack developed in some of the plots. This reached serious proportions where the spray programme for the control of the second generation was less thorough.

In Kentucky, three spray programmes were tested ; the " half sprays " were sprays applied on only one side of the tree. All plots were given a double calyx and 1½ cover sprays of lead arsenate and sulphur before the experiments were started on 30th April. The three treatments consisted of 9½ applications of nicotine sulphate, Mississippi bentonite and oil ; seven of nicotine sulphate and bentonite at half strength with oil, and 6 oz. DDT ; and three of 6 oz. DDT with lead arsenate, Bordeaux mixture and oil, followed by three of 1 lb. DDT, Bordeaux mixture and oil, and one of 1 lb. DDT with oil. The final sprays were applied on 4th August in the first schedule and 24th July in the others. The numbers of larvae and superficial injuries per 100 apples at the end of the season were 0·2–0·4 and 0·8–1·4, respectively, for the third schedule, 1·4 and 2·6 for the second, and 4·6–5·8 and 4·2–7·1 for the first. The second schedule gave outstanding fruit quality and foliage vigour, although not quite such good controls as the third, in which approximately twice as much DDT was used. No third-generation attack was evident except in the plots that received the first treatment. Severe injury to foliage resulted within a day of the last application in the third programme ; it was believed that heavy deposits of oil-wet DDT were responsible. DDT is moderately soluble in spray oils, and when used in mixtures containing them, regardless of whether it is mechanically mixed, coated or impregnated in an inert material, or is in an emulsified solution, it has a strong tendency to become preferentially wet by the oil. As the agitation of the spray mixture continues, these oil-wet particles clump together in increasingly large masses, which may either float or sink when agitation ceases, and eventually clog the filter of the sprayer. The consistency of these masses varies with the ratio of DDT to oil and is also affected by the other ingredients of the spray. The process can be prevented by the addition of 4 oz. Wyoming bentonite, except in some mixtures such as those including kaolin, and a slurry (prepared 20 minutes beforehand) of 2 oz. soy-bean flour and 2 oz. spray lime that proved effective in 1945 in mixtures not including pyrophyllite. In mixtures in which lime could not be used, such as those including fixed nicotine, 2–4 oz. soy-bean flour alone was sufficient.

One of the most important factors determining the effectiveness of a DDT spray is the particle size of the DDT deposited. In special tests on apples, DDT having an average mean surface-particle diameter of 2·5 μ and used at 12 oz. per 100 U.S. gals., had an average larvicidal efficiency of 95 per cent., compared with 74 and 71 per cent., respectively, for diameters averaging 10 and 25 μ. Thus, if the average particle size is more than 12 μ, the effectiveness of a

spray containing 1 lb. DDT, on the basis of the tests, will be less than that of standard nicotine sulphate with bentonite and oil.

In a test in Arizona to assess the residues left on the fruits at harvest by representative DDT spray programmes, it was found that residues sometimes exceeded the legal tolerance [**35** 110] when DDT was used at rates exceeding 8–12 oz. per 100 U.S. gals. in second-brood sprays or was applied within 4–6 weeks of harvest and when oil was applied with or following DDT at high dosages. However, sprays of 6 oz. DDT per 100 U.S. gals., combined with lead arsenate, or with nicotine sulphate and bentonite and 0·25 per cent. oil, left residues within the tolerance.

Small predacious insects usually prevent *Paratetranychus pilosus*, C. & F., and *Tetranychus bimaculatus*, Harvey, from becoming injurious on apple in this region, but since the first use of DDT there in 1943, these mites have increased to destructive levels each season on most of the experimental plots [**35** 82]. In 1945, they were slow in becoming numerous, owing to the unfavourable weather, but they increased rapidly from early July until early September. The progress of the infestation on the Rome Beauty plots that received various spray programmes in Indiana is shown in a table. On 9th August, 12 days after the last spray, infestation by *Paratetranychus* was heaviest in the plot treated with full-strength DDT without oil, which contained trees on which DDT had been used in 1944, and that by *Tetranychus* on trees sprayed with standard lead arsenate. The smallest populations of each species occurred on the three plots sprayed with DDT and 0·25 per cent. oil. Since these had the heaviest DDT residues and since *Paratetranychus* increased somewhat and *Tetranychus* very greatly on them between 9th August and 12th September it is assumed that the sprays of DDT and oil were highly toxic to both species when freshly applied, but that their residual toxicity was low to them, although high to their predators. It is considered that almost perfect control of first-generation larvae of *C. pomonella* and of *P. pilosus* might be obtained with sprays of DDT and oil, but that special late sprays would be required against *Tetranychus*. Of the sprays containing DDT, the combinations of DDT, nicotine sulphate, bentonite and oil gave the least trouble from *Tetranychus* and *Paratetranychus*, although only 0·25 per cent. oil was used.

In the large orchard in Indiana, parts of the experimental areas were sprayed with a 3 per cent. oil emulsion from opposite directions on 12th and 14th March, when the buds were in the early delayed-dormant stage. On 20th August, the average numbers of *Tetranychus* and *Paratetranychus* in those parts of the DDT-treated plots to which the dormant spray had been applied were only one-third of those where it had been omitted. The heaviest infestation of *Paratetranychus* occurred within the area receiving a spray programme of full-strength DDT and oil, in a plot on which DDT had also been used in 1944. The trees surrounding this plot had been sprayed with nicotine-bentonite and oil in 1944, and the development of mite infestation on these was much less striking. It appeared that the use of the dormant oil spray is desirable, but is not sufficient by itself to check the mites where DDT is applied year after year. In an attempt to develop a satisfactory programme for the control of mites, various sprays were applied twice, on 20th and 30th July, to trees in the heavily infested plot that had already received the first five cover sprays of full-strength DDT. The results of nine of these are shown in a table, both species being considered together. At the final count, on 17th August, actual decreases in the mite population were given by DDT with the dicyclohexylamine salt of dinitro-o-cyclohexylphenol, with mineral oil or with nicotine sulphate, bentonite and oil, as compared with an increase of 840 per cent. for no additional treatment. Oil sprays without DDT resulted in some increase, as also did nicotine bentonite and oil alone, and DDT without oil in large increases, though still less than in the controls. The dinitro compound caused some injury to foliage, though less than that due to the mites where these were not controlled.

Shaw (J. G.) & Starr (D. F.). **Development of the immature Stages of *Anastrepha serpentina* in Relation to Temperature.**—*J. agric. Res.* **72** no. 8 pp. 265–276, 6 figs., 6 refs. Washington, D.C., 1946.

In recent years, large numbers of adults of *Anastrepha serpentina*, Wied., which infests various fruits of economic importance [*cf. R.A.E.*, A **33** 52, 397], have been found in *Citrus* groves of the lower Rio Grande Valley of Texas and Tamaulipas, Mexico, and in view of the consequent threat to the *Citrus* fruit industry, investigations on its development were carried out in the laboratory at Mexico city. The technique for obtaining eggs was one developed in the course of unpublished studies on *Ceratitis capitata*, Wied., to avoid the task of searching for them in whole fruits. The flies are allowed to oviposit in pieces of fruit skin, with a very little pulp adhering to it, fixed on glass plates with paraffin wax. The eggs can be seen through the glass and were removed with a camel's-hair brush and placed on ink-blackened filter paper in watch glasses. The filter-paper was kept saturated with 0·1 per cent. cupric chloride, which prevents the growth of fungi and did not affect the hatching of the eggs. The larvae were reared in a succession of pieces of fruit between glass plates and allowed to pupate in sand.

Adults reared from fruits of *Achras zapota* and *Calocarpum mammosum* and caged with skin sections of *A. zapota* and peach at 25°C. [77°F.] and a relative humidity of about 60 per cent. began to oviposit 16 days after emergence and showed a highly significant preference for *A. zapota*. The eggs were kept at temperatures of 10–37·8°C. [50–100°F.], but only those at 15–32·5°C. [59–90·5°F.] hatched, the incubation period varying from 361 hours at 15°C. to 64·5 at 32·5°C. The larvae were reared in pieces of *A. zapota* or peach. No larvae kept at 10 or 35°C. [50 or 95°F.], and few at 15 and 32·5° completed development, 20–30°C. [68–86°F.] being the optimum for larval survival. The length of the larval and pupal stages varied from 17·4 and 12·4 days at 30° to 24 and 26·5 at 20° for insects bred in peach and from 11·7 and 12·3 days to 19·4 and 27·3 for those bred in *A. zapota*. The total development period ranged from 121 days for one individual reared in peach at 15°C. to 26 days for individuals reared in *A. zapota* at 30 and 32·5°C. ; development was invariably slower in peach than in *A. zapota* at the same temperature, the difference occurring in the larval stage. When the rate of development in each fruit, measured by the reciprocal of time in days, was plotted against temperature, linear regression lines were produced.

Steinweden (J. B.). **The Identity of certain common American Species of *Pulvinaria* (Homoptera : Coccoidea : Coccidae).**—*Microentomology* **11** pt. 1 pp. 1–28, 13 figs. Stanford Univ., Calif., 1946.

Owing to the confusion existing in the classification of the genus *Pulvinaria*, species collected in California or intercepted in quarantine in the United States have been identified chiefly on the basis of food-plants and common repute as to identity, specimens from deciduous fruit trees, grape-vines and orchids having been considered to be *P. amygdali*, Ckll., *P. vitis*, L., and *P. floccifera*, Westw., respectively. As this led to misidentifications, and it became apparent that only a few species that have very distinctive characters or are definitely associated with certain food-plants could be determined with certainty, the author undertook a study as a result of which he discusses the status of 13 species, describes and figures their characters, and gives a key to them. Eleven other species of the genus have been recorded from North America, but four of them are synonyms, and seven have not been adequately studied.

P. amygdali was described from peach in New Mexico, but subsequent records from peach, apple, plum and prune in different parts of the United States are all considered to be doubtful or definitely erroneous. *P. rhois*, Ehrh., which was

studied from material including specimens from *Rhus diversiloba*, apple, grape-vine, prune and plum in California and from plum in Georgia and North Carolina, has been misidentified in collections and in the literature as *P. amygdali* from apple, grape and prune in California. The only published record of *P. pruni*, Hunter, is its original description from plum in Kansas, but specimens considered to belong to this species were obtained from plum and *Prunus* sp. in Oklahoma and from plum in Texas.

P. innumerabilis, Rathvon, is widely distributed in the United States, occurs characteristically on maple (*Acer*), *Parthenocissus* (*Ampelopsis*), *Celtis* and *Vitis*, and is recorded on several other plants there, including persimmon in Texas. *P. occidentalis*, Ckll., has been found on various plants in the western United States and British Columbia, including pear, plum and quince in the United States. Since 1909, these two species have been considered synonyms of *P. vitis*, which was described from grape-vine in Europe and is not definitely known to occur in America. However, comparison with material, including specimens from grape in Italy and Switzerland, that may be assumed to represent *P. vitis* as understood by European authors, indicated that *P. innumerabilis* is not a synonym. *P. occidentalis* may be, as the two species are very similar, but it is not here synonymised, in view of the uncertain identity of the European species. Material that seemed very close to *P. occidentalis* was taken on peach in New York.

P. floccifera was described from *Camellia* in France and has been recorded on other plants in various countries, the material studied including specimens from *Camellia* in California and fern and various trees in California, Oregon and British Columbia. All records of its occurrence on orchids, however, are considered erroneous. *P. phaiae*, Lull, which was described from orchids in a greenhouse in Massachusetts, but was erroneously synonymised with *P. floccifera*, has been found on various orchids in California and New York, and it appears that at least two other species of *Pulvinaria* infest orchids elsewhere.

P. psidii, Mask., has been recorded from a number of food-plants from many localities in America, Asia and Africa ; the material studied included specimens from coffee in Uganda, orange in Formosa, guava in Ceylon, and mango in Florida. This species is said to be a serious pest of guava and certain ornamental plants in Florida, and occasionally occurs on ornamental plants in greenhouses in California. *P. citricola*, Kuw., was described from *Citrus*, oriental persimmon (*Diospyros kaki*) and other plants in Japan and has been found on oriental persimmon in California and *Hibiscus* in Maryland. The other species dealt with are *P. acericola*, Walsh & Riley, which is widely distributed on maple in the eastern half of the United States and is also recorded from a few other plants there, including Japanese persimmon [*D. kaki*] in Louisiana ; *P. peninsularis*, Ferris, which is recorded on a variety of plants in Lower California and Texas, including orange in Lower California ; and *P. hydrangeae*, sp. n., on *Hydrangea hortensis* in California.

McKenzie (H. L.). **Supplementary Notes on the Genera *Aonidiella* and *Parlatoria* (Homoptera : Coccoidea : Diaspididae).**—*Microentomology* **11** pt. 1 pp. 29–36, 2 figs., 4 refs. Stanford Univ., Calif., 1946.

Characters are given separating the genera *Aonidiella* and *Hemiberlesia*, *A. paucitatis*, McKenzie [*R.A.E.*, A **31** 207], is transferred to *Hemiberlesia*, and *A. marginipora*, sp. n., and *A. replicata*, Ldgr., are described from *Hydnocarpus* sp. in Uganda. The key to the species of *Aonidiella* [**26** 470] is revised to include the new one and eliminate *Hemiberlesia paucitatis*, and additional food-plant and locality records of species of this genus are given, based on quarantine interceptions and other material. They include *A. comperei*, McKenzie, on coconut from the Philippine Islands, *Citrus* from Thailand and Guatemala and grape from Haiti ; *A. eremocitri*, McKenzie, on an orchid from

Thailand and coconut from the New Hebrides and the Solomon Islands; *A. eugeniae*, Hemp., on *Myrciaria* (*Eugenia*) *cauliflora* from Brazil; *A. inornata*, McKenzie, on *Piper betle*, *Areca catechu*, *Cycas revoluta* and other plants from Hawaii, mango and *Citrus* from the Philippines and papaya from Formosa; *Aonidiella orientalis*, Newst., on *Litchi chinensis* from China, *Dalbergia sissoo* from India, coconut and mango from the Philippines, coconut from Panama and the Bahamas, *Annona squamosa*, coconut and date palm from Cuba and coconut, mango and *Spondias cytherea* from Porto Rico; and *A. taxus*, Leon., on *Podocarpus macrophylla* from California and Japan and *Taxus adpressa* from Japan.

Ferris (G. F.). **Information concerning the Genera** *Chortinaspis* **and** *Aspidiotus* **(Homoptera : Coccoidea : Diaspididae).**—*Microentomology* **11** pt. 1 pp. 37–49, 5 figs., 1 ref. Stanford Univ., Calif., 1946.

The author reviews the species of the genus *Chortinaspis* and gives descriptions of two of them, one of which is new, and a key. He also gives supplementary notes to his discussion of the genus *Aspidiotus* [*cf. R.A.E.*, A **30** 393], including the characters of two species of which adequate material was not previously available, a revised key to the species and a few corrections to the list of names.

Steinweden (J. B.). **Methyl Bromide Fumigation.**—*Bull. Dep. Agric. Calif.* **34** no. 1 pp. 4–14, 3 figs., 43 refs. Sacramento, Calif., 1945.

An account is given, largely from the literature, of the use that is made in the United States of fumigation with methyl bromide in the commercial control of insects attacking plants and various commodities and in the treatment of fruit, vegetables, nursery stock and containers under quarantine regulations. It includes information on the chemical and physical properties of the fumigant, its effect on insects and plants, the precautions that minimise risk to the operators, the various methods of application, requirements for efficiency [*cf. R.A.E.*, A **31** 513; **32** 155], schedules [**32** 373; **34** 26, 110], and the treatments recommended for nursery stock, fruit, vegetables and stored products in California, where it is extensively used for the fumigation of fruit and fruit-boxes moved from the area infested by the Oriental fruit moth [*Cydia molesta*, Busck] [**34** 110]. Variable results were obtained in tests with growing nursery stock fumigated under gas-tight tarpaulins in this State, depending largely on atmospheric temperatures and the type of stock undergoing treatment. The results were usually good on stock for which high schedules could be used, such as dormant pear infested with pear root Aphid [*Eriosoma lanuginosum*, Htg.], and also when plants bearing leaves were fumigated for two hours at outside temperatures of 80–90°F. The temperature under the tarpaulin cannot be controlled, and direct sunlight increases it so much that the plants cannot tolerate the treatment. The schedules recommended for fumigation chambers can be adapted for use under tarpaulins by increasing the duration of the exposure by 30 minutes or the dosage by 8 oz. per 1,000 cu. ft.

Smith (H. S.), Flanders (S. E.) & Basinger (A. J.). **The Control of** *Saissetia oleae* **by** *Metaphycus helvolus* **(Compere).**—*Bull. Dep. Agric. Calif.* **34** no. 2 pp. 93–94, 2 refs. Sacramento, Calif., 1945.

During the two years between the summers of 1937 and 1939, thousands of parasites were liberated in *Citrus* and olive groves in southern California against *Saissetia oleae*, Bern. They included *Metaphycus helvolus*, Comp., which was introduced from South Africa in 1936–37 [*R.A.E.*, A **29** 385–386], and as this species appeared to be becoming of importance as a control agent, a study was begun in 1939 in an area where it had not previously been released to provide

data on its progress. The experiment was carried out in two adjoining ten-acre blocks of grape-fruit trees separated by a wind-break of *Eucalyptus* running from east to west. The percentages of trees heavily infested by *S. oleae* in November 1939 were 94 in the southern block, in which the parasites were released, and 79 in the northern one, in which they were not. The total numbers of *Metaphycus* released were 17,500 during November–December 1939 and 90,400 in the following year, when releases were terminated on 21st August. Populations of *S. oleae* were greatly reduced as a result of parasitism and feeding by *Metaphycus* [**32** 192] before the spring of 1940, but the numbers remaining were sufficiently high to cause severe re-infestation so that the percentages of trees heavily infested in August were 76 in the southern block and 81 in the northern one, though the parasites were gradually spreading through the latter. The percentages of scales parasitised increased in both blocks during the autumn and winter of 1940–41 and were 90 in the southern block and 83 in the northern one on 26th March 1941. Infestation in both blocks was classed as heavy in 1940 and as light from the spring of 1941 until August 1943, when control measures were applied against the red scale [*Aonidiella aurantii*, Mask.] and *S. oleae* almost disappeared.

ARMITAGE (H. M.) & STEINWEDEN (J. B.). **The Fumigation of California Dates with Methyl Bromide.**—*Bull. Dep. Agric. Calif.* **34** no. 3 pp. 101–107, 1 fig., 4 refs. Sacramento, Calif., 1945.

Methyl bromide is commonly used in California for the fumigation of dates against dried-fruit insects, principally *Carpophilus hemipterus*, L., but a number of cases of poisoning occurred during the packing season of 1944–45 among employees in packing houses and processing plants who were exposed to the fumes. Reports on the problem were presented and discussed at a meeting of state officials and others concerned with it in February 1945. Some of them are briefly reviewed in this paper, which also contains an account of the chemical and physical properties of methyl bromide, its advantages as a fumigant and its effects on man, including the symptoms caused by repeated exposure to low concentrations, and summaries of the specifications for fumigation chambers, the precautionary measures that should be adopted during its use, and the treatment recommended for the fumigation of dates. The symptoms in the poisoned operators were mild, and were mainly limited to severe headache. It was reported that a concentration of 30–50 parts methyl bromide in 1 million parts air is dangerous, and that the concentrations in some of the rooms inspected were as high as 100–200 p.p.m. and reached 300–400 p.p.m. near faulty dispensing equipment, which was common. Suitable gas masks and halide leakage detectors were not in general use, and there was little equipment for circulating gases during and after fumigation. In some cases, the methyl bromide escaped from the fumigation chambers into the packing houses, and when the windows of the latter were closed in cold weather, considerable concentrations could be built up without detection.

A dosage of 1 lb. methyl bromide per 1,000 cu. ft., including load, applied at temperatures between 60 and 90°F. for an exposure period of 24 hours, is recommended for the fumigation of fresh or processed dates. A fan with a diameter of at least 10 ins. should be operated during the injection of the gas and for 15 minutes afterwards, and there should be an air-space 3–4 ft. high at the top of the chamber as well as ample space for circulation between the containers undergoing treatment and through the centre of large chambers. The flavour of dates was seriously impaired when they were fumigated and were then left with the gas in the fumigation chamber for 15 days for convenience and to avoid reinfestation. Tests in January–March 1945 indicated that the residue of methyl bromide on dates fumigated according to the recommended schedule is unlikely to be sufficiently great to prove injurious to consumers and that this treatment

has no deleterious effect on flavour. Where dates are to be stored in the closed fumigation chamber, however, the gas should be exhausted after 24 hours.

Essig (E. O.). **The Pit-making** *Pittosporum* **Scale.**—*Bull. Dep. Agric. Calif.* **34** no. 3 pp. 134–136, 1 fig., 1 ref. Sacramento, Calif., 1945.

Lists are given of the synonyms of *Asterolecanium arabidis*, Sign., the European countries and parts of the eastern United States in which it has been collected, and the many unrelated plants, comprising upwards of 60 species, on which it has been observed there or in California. It was first reported in California in 1943, has been found in ten counties there, and is regarded with concern because of the serious injury it causes to many valuable ornamental plants; 39 species were infested by it in a single nursery. It was abundant on *Lotus scoparius* along main roads in eight counties. *Pittosporum tobira* and privet (*Ligustrum*) appear to be the plants most seriously damaged by it. A toxin injected during its feeding causes the tips of the shoots to become enlarged or bent, growth is severely stunted and both nursery stock and well-established bushes are eventually killed. Infested plants cannot produce flowers, and pits and depressions may develop beneath the Coccids.

Keifer (H. H.). **Eriophyid Studies XV.**—*Bull. Dep. Agric. Calif.* **34** no. 3 pp. 137–140, 2 figs., 1 ref. Sacramento, Calif., 1945.

This part of a series [*cf. R.A.E.*, A **34** 110] includes descriptions of two new species of *Aceria* from California. They are *A. camelliae*, which occurs under the scales of the flower buds of *Camellia japonica* and causes the flowers and buds to turn brown, and *A. baccharices*, which forms galls on the leaves of *Baccharis* spp.

Three seasons' observations in California indicated that peach seedlings without basal leaf glands are more susceptible to attack by *Vasates* (*Phyllocoptes*) *cornutus*, Banks, in spring than seedlings in which these glands are present, presumably because their viscid secretion protects the unfolding leaves. This early feeding causes the leaves to become curled longitudinally, and the damaged leaves are conspicuous from a considerable distance. Early feeding also causes small yellow spots to appear on the leaves. Prolonged feeding during May–July causes the injury known as silver-leaf.

Animal Pests.—*30th Rep. exp. Res. Sta. Cheshunt 1944* pp. 32–57, 11 refs. Cheshunt, Herts., 1945.

E. R. Speyer & W. J. Parr state that further observations on the distribution of infestation by *Tetranychus telarius*, L., on tomato in glasshouses in Hertfordshire gave additional support to the suggestion that plants in the rows beneath the ridge of the roof are the first to be invaded by mites as they come out of hibernation, but that centres of infestation may arise anywhere from plants that already have mites on them in the propagating house [*cf. R.A.E.*, A **33** 405]. The dispersal of mites to surrounding plants appeared to be slow until after the middle of May.

Experiments were carried out between January and March 1944 on the fumigation of greenhouses with hydrocyanic acid gas from a proprietary "cyanide" powder calculated to liberate as much of the gas as 40 per cent. of its weight of sodium cyanide decomposed by 30 per cent. sulphuric acid by the pot method. The powder was sprinkled at rates of $\frac{1}{4}$–$\frac{3}{4}$ oz. per 1,000 cu. ft. on the paths of houses containing lettuces planted out in the ground in November 1943 and infested with *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) and *Myzus ornatus*, Laing, lettuce plants just beginning to heart in pots on the staging, infested with these Aphids and *Macrosiphum* (*Myzus*) *solani*, Kalt., uninfested lettuce seedlings, chrysanthemum plants infested

by *M.* (*Macrosiphoniella*) *sanborni*, Gill., and young tomato plants in pots on the staging and on the ground. The mean minimum and maximum temperatures were 49 and 59°F. Applications were made after sunset and the houses closed overnight. None of the treatments injured the lettuce plants, whether they were young or ready for cropping, wet or comparatively dry at the root. Dosages below $\frac{1}{2}$ oz. powder per 1,000 cu. ft. did not injure the tomato plants, but $\frac{1}{2}$ oz. caused slight leaf-curl and spotting on soft-grown plants that were moist at the root, and $\frac{3}{4}$ oz. caused leaf injury to hard-grown plants that were moist at the root, but not to those that were dry, and slight and severe injury, respectively, to soft-grown plants that were dry and wet at the roots. Injury was more pronounced on plants in pots on the ground than on those on the staging. A dosage of $\frac{1}{4}$ oz. sodium cyanide, applied by the pot method, caused no permanent injury provided that the plants were drooping for lack of moisture at the time of fumigation. The highest dosage of powder caused slight leaf-scorch on chrysanthemum when the pots were well watered immediately before fumigation.

No apparent differences were observed in the effect of the gas on the different Aphids on lettuce, but the alate and apterous adults of *M. sanborni* appeared to be more resistant. The fourth-instar nymphs (of apterous or alate forms) and adults of all species were much more resistant than the early instars. No species was materially affected by dosages of less than $\frac{1}{3}$ oz. powder per 1,000 cu. ft., but infestations were greatly reduced by $\frac{1}{3}$–$\frac{1}{2}$ oz. in fairly gas-tight houses, in spite of the recovery of a very high proportion of fourth-instar nymphs and adults. Dosages of $\frac{3}{4}$ oz. gave control in both tight and leaky houses, because young and susceptible nymphs far outnumbered older individuals in the colonies and reproduction was slow at the prevailing temperatures. There was no evidence that small quantities of gas adsorbed on the leaf-surface or dissolved in moisture on it killed insects after fumigation, since surviving individuals recovered when kept on fumigated plants. All the Aphids showed more resistance to hydrocyanic acid gas than had been expected ; they were hardly affected by dosages that killed 85–95 per cent. of the adults of *Trialeurodes vaporariorum*, Westw., which was introduced into some of the houses on tomato plants. It is concluded that cyanide powders distributed along the paths are suitable for the control of Aphids on lettuce, and that a quantity equivalent to $\frac{1}{4}$ oz. sodium cyanide per 1,000 cu. ft. ($\frac{1}{3}$ oz. in blocks of houses) should be used. The presence of living adults after fumigation does not mean that the treatment has been unsuccessful, but it should be repeated if numbers increase. Except in the case of *M. sanborni* on chrysanthemum, it is preferable to the use of nicotine shreds, the smoke from which tends to remain above the level of low-growing plants. Tomato plants can safely be fumigated against Aphids and Aleurodids with dosages equivalent to $\frac{1}{8}$–$\frac{1}{6}$ oz. sodium cyanide per 1,000 cu. ft. provided that they are drooping for lack of moisture. Such fumigation should be carried out overnight shortly before the plants are set out in the ground.

Observations on the use of tetrachlorethane as a fumigant against *Trialeurodes vaporariorum* showed that the smallest dosage that will effect any lasting control is 8 fl. oz. per 1,000 cu. ft. in gas-tight houses and 10 fl. oz. in leaky ones [*cf.* **31** 179], and that it is necessary to repeat the treatment 2–3 weeks later, according to temperature, unless the parasite, *Encarsia formosa*, Gah., has been introduced. The liquid should be poured on the path early in the afternoon, and the house kept closed until as late as possible on the following day, without allowing direct sunlight to fall on the plants while the vapour is still present ; the plants should be moist at the roots. Motionless adults should be kept under observation for six days after fumigation to determine the proportion killed, since they sometimes revive after two days or more. The later " scale " stages are not all killed by dosages of less than 10 fl. oz., even in gas-tight houses, and the eggs are not affected by dosages that are safe

for growing plants, but an application of 5 fl. oz. kills a high proportion of adults and is of great value if these are detected on tomato plants in propagating houses early in the growing season, when they are laying few eggs. Fumigation with this dosage for 17 hours at a temperature of 56–60°F. on 28th March 1944 killed all but one of 126 adults of *T. vaporariorum*, but only one of 126 adults of *E. formosa*.

Leaf-miners of tomato, received from the Channel Islands and recorded as *Liriomyza* (*Phytomyza*) *solani*, Macq. [**28** 134], have now been identified as predominantly *L. strigata*, Mg., which has of recent years become a pest of tomato seedlings in glasshouses in Hertfordshire during January and February. It is now considered that the leaf-miner obtained from tomato in a nursery in Middlesex in 1926 [*cf.* **26** 710] was *Phytomyza atricornis*, Mg., but that the one that was numerous in another nursery in the same county in 1935–36 was correctly determined as *L. solani* [**25** 668]. Mines that have been found in small numbers in tomato foliage at Cheshunt since 1935, chiefly in late summer, are almost certainly those of *L. strigata*, and the miner that is now prevalent in a number of nurseries in the Lea Valley throughout the growing season is also this species. Larvae of *L. strigata* were found mining in the leaves of lettuce on 21st December 1943 and adults emerged from the pupae formed in January 1944. The increase of *L. strigata* in commercial nurseries in this district has coincided with the cultivation of tomatos with succulent foliage, which is preferred for oviposition, and the application of large amounts of water to the soil favours adult emergence. Larvae of *P. atricornis* were found in lettuce in and near Cheshunt in October and November 1943. They pupated in their mines and those found in November gave rise to adults early in December.

Observations on the bionomics of *L. strigata* were made in 1943 and 1944. Although breeding continues in the leaves of lettuce in winter, pupae in unheated glasshouses at that season lie dormant in the soil. Digging or trenching buries them to considerable depths, but the adults emerge 3–4 weeks after the heat is turned on and make their way to the surface. Adults of the overwintered generation are present for 3–4 weeks in January or February, but are rarely seen. On tomato seedlings, the females feed from punctures made with the ovipositor on the underside of one of the cotyledons and oviposit in the other, probably beginning about five days after germination. When young rough leaves were provided, both feeding and oviposition occurred in punctures on the upper surface, but under normal conditions neither eggs nor young larvae were found in the rough leaves of tomato plants less than two months old. Eggs were rarely observed and it is concluded that the incubation period is short. Only one egg is deposited in a cotyledon, and the larva mines in both cotyledons and then up the stem into the first pair of leaves ; it sometimes returns to the cotyledons to complete feeding, but does not enter the growing point. If eggs are deposited in both cotyledons, the larvae occupy opposite sides of the plant. The larvae mature in some 5–8 days and then drop to the ground to pupate in the soil. During the propagation of tomato plants, most of the pupae are probably removed from the houses in the soil of the seed-boxes, but there may be some in the soil beneath the staging. The former are likely to die unless the soil is heaped outside and kept moist by rain, in which case the resulting adults will increase the population on weeds near the glasshouses and provide a source of infestation during the summer. Adults emerge from the soil in the houses towards the end of February, after a pupal period of about 6–8 weeks, are present for about a week and oviposit in the leaflets of plants at the setting-out stage. Only one egg is deposited in a leaflet, and often only one in a whole leaf, and the mine of a single larva may extend into three leaflets, or may be confined to one leaflet on older plants. The larvae mature in about a week and the pupal stage lasts only 2–3 weeks in summer, so that severe infestation develops on tomato plants with soft foliage in July and August.

Of the measures that have been recommended against the leaf-miner, the application of atomised sprays or dusts containing nicotine is only partly effective, the removal of all cotyledons from the seedlings causes more injury than infestation itself, and removing infested leaflets from older plants is of little value and checks the Braconid parasites of the larvae. The measures most likely to reduce infestation are steam sterilisation of the soil of propagating houses before the staging is introduced, and growing plants with a harder type of foliage in houses in which infestation has occurred in the previous season.

Adults of *Aphodius fimetarius*, L., and *A. subterraneus*, L., which are common in horse manure, have recently injured mushrooms in widely separated localities by devouring large portions of the caps during June and July. Treatment of the soil surface with derris, pyrethrum or nicotine powder did not control them, but some years ago, large numbers were trapped in tomato houses at Cheshunt with mangolds, cut in halves and put cut-side downwards on the soil surface.

Since the number of adults of *Polia oleracea*, L., trapped in experimental tomato houses between 20th January and 16th May in jars containing a bait of ale, powdered malt extract and sodium fluoride [*cf.* **31** 176] was 550 in 1944, as compared with 133, 281 and 348 in 1941, 1942 and 1943, respectively, it is evident that this Noctuid is increasing in spite of annual spraying with lead arsenate and trapping from January to mid-May and from August until the beginning of October. It appears that the increase is due to moths that enter the houses in June and July, and that trapping throughout the season is essential in areas in which *P. oleracea* has long been established. A powder containing 5 per cent. DDT, applied to egg-masses 2, 4 and 7 days old, gave 79 per cent. mortality of larvae in the process of hatching; the degree of control obtained depended on the depth of the egg-mass and not on the age of the eggs. Untreated eggs hatched 8–10 days after deposition with a mortality of less than 1 per cent. An emulsified solution of DDT gave complete mortality at high dilutions. It apparently penetrated the shell in quantities insufficient to prevent development of the embryo, but sufficient to enfeeble the fully formed larva to a degree that prevented it from emerging from the egg; larvae in eggs within the mass perforate the shell, but die in the process of hatching.

W. H. Read gives an account of tests of DDT against larvae of *Polia oleracea* on tomato. A 5 per cent. dust, prepared by mixing an acetone solution of commercial DDT with kaolin, evaporating the solvent and passing the product through a 100-mesh sieve, gave complete mortality of 88 larvae of all instars on 40 plants about 4 ft. high in a small greenhouse. Only 2 oz. dust was used in all. All the larvae fell to the ground within a few hours; some were capable of slight movement for 48 hours, but none returned to the plants, and several large larvae that were transferred, three hours after being dusted, to untreated tomato leaves died without attempting to feed. Fully grown larvae that were placed on the plants 12 days after dusting, and newly hatched larvae put on 20 days after, all died; the plants were not damped overhead. The dusts did not injure the plants, and fruits that received an excessive amount of dust were free from abnormal taste when it was brushed off. In small-scale greenhouse tests, emulsified solutions containing 0·02 per cent. DDT in organic solvents killed larvae in all instars, and those containing 0·007 per cent. killed newly hatched ones. The residue on plants sprayed with 0·02 per cent. DDT retained its toxicity to fourth-instar larvae for six days. Since *Tetranychus telarius* is not susceptible to DDT, experiments were carried out with petroleum oil emulsions (1 : 100) to which a solution of 20 oz. DDT and 16 oz. triethanolamine oleate in ½ gal. acetone was added to give 0·0215 per cent. DDT. A single application killed all larvae of *P. oleracea* in all instars in a small greenhouse and in large-scale tests and also killed moths flying in the greenhouse. In other tests, a spray containing 0·01 per cent. DDT and 0·75 per cent. oil killed

almost full-grown larvae when they fed on sprayed foliage, but did not prevent some full-grown larvae that did not feed from pupating after being sprayed; the same spray containing 0·02 per cent. DDT killed full-grown larvae by contact. The sprays caused no injury to plants or fruit, and fruit sprayed with mixtures containing 0·08 per cent. DDT had no unusual flavour.

ROZSYPAL (J.). **Ein Beitrag zur Kenntnis des Mohnwurzelrüsslers** *Stenocarus fuliginosus* **Mrsh.** [A Contribution to the Knowledge of the Poppy Root Weevil, *S. fuliginosus*.]—*Folia ent.* **4** fasc. 1–2 pp. 34–60, 17 figs., 12 refs. Brno, 1941. (With a Summary in Czech.)

This paper on the bionomics of the weevil, *Stenocarus fuliginosus*, Marsh., on poppy (*Papaver somniferum*) in Moravia, which has already been noticed from a summary [*R.A.E.*, A **31** 52], contains a section (pp. 55–59) in which F. Gregor describes all stages but the eggs of the Ichneumonids, *Thersilochus gibbus*, Hlmgr., subsp. *stenocari*, n., and *Phygadeuon rozsypali*, sp. n. [*cf.* **31** 53]. The former was reared from pupae of *S. fuliginosus* and *S. cardui*, Hbst., collected in fields of poppies and appears to be of considerable economic importance. The larva pupates within the pupal cell of the host. *P. rozsypali* was reared in small numbers from pupae of *S. fuliginosus*, but it was not known whether it was a primary parasite or a hyperparasite attacking *Thersilochus*.

HÄRDTL (H.). **Über die Lebensweise der** *Lyda stellata* **als Grundlage einer Bekämpfung.** [The Mode of Life of *Acantholyda pinivora*, Ensl., as a Basis for its Control.]—*Z. angew. Ent.* **30** pt. 2 pp. 163–223, 15 figs., 46 refs. Berlin, 1943.

An account is given of observations on the bionomics of *Acantholyda pinivora*, Ensl. (*Lyda stellata*, Christ) on pine carried out between 1935 and 1940 in neighbouring districts in Czechoslovakia and Saxony where an outbreak of this sawfly was in progress. It has long been present in the area, and its history there is briefly reviewed. Oviposition usually begins in mid-May, and the eggs hatch in 10–14 days. Females contained about 83 eggs but did not deposit all of them if the weather was cool. They were inserted singly into slits in the needles. In the laboratory, the eggs hatched on 12th June, and the larvae crawled to the bases of May shoots, where they spun loose webs and fed on the May needles. After 12–14 days they attacked older needles, feeding within thicker tubular webs; some of the needles at the tip of the May growth remained unattacked, and caused the characteristic tufted appearance of infested twigs. The larvae entered the soil about 20 days after hatching. Tests showed that a larva consumed an average total of 11·8 ft. of pine needles. In the field, mass feeding was observed from 14th to 22nd June. The first larvae hatched on 11th June, on lightly infested trees on a high, sandy ridge, and the last on 26th June, in damp, shady valleys. The feeding time rarely exceeded 20 days, and examination of sample trees showed that an average of 76 per cent. of the May shoots was destroyed.

The injury caused to the trees falls into four distinct stages. In the first, the needles at the tip of the tree are thinned, and a few May shoots are damaged on the tips of the branches near the highest whorls; in the second, almost complete defoliation of the tips and some attack on the outside of the rest of the crown is often accompanied by dieback and the development of dormant buds on the lower branches, indicating a physiological weakening of the tree; in the third, the tip is entirely defoliated except for a tuft of needles, the foliage on both inner and outer parts of the crown is sparse and there are numerous dead May shoots; in the last stage, there is total defoliation and the greater part of the crown dies, owing less to the direct effects of attack than to the prolonged weakening of the tree. The most likely explanation of this development of the

attack is that eggs are laid in the most sunny and airy positions on the tree, and the larvae do not attack the inner part of the crown, until the available supplies of food on the circumference are exhausted. Measurement of the annual rings of trunks of injured trees showed that the growth of new wood was least on those trees that had suffered the greatest loss of needles.

On entering the soil, the full-fed larvae construct cells, at a depth of 4–6 or occasionally 8 ins., in the litter or the sand beneath it. Most of them overwinter twice, and pupate towards the end of the second winter. A few months before pupating, they develop the so-called pupal eyes. Of larvae removed from the soil in January and February 1940, 27·7 and 23·1 per cent. had pupal eyes, and these developed into apparently normal adults in 24 days or less, being the only ones that did so in that year. Examination in early April showed that about 30 per cent. of the population had pupated; larvae from southerly slopes were more advanced in development than those from northerly ones. The pupal stage lasts only a few weeks, during which the insects are extremely sensitive to changes in the environment; few of those collected in the field developed into adults. When the adults emerge, mostly at the beginning of May, they remain in the ground and then on it for several hours or even days. Maximum flight and oviposition occur in late May or early June; only short flights, from branch to branch, were seen. More males than females were observed during the first few days of adult life, when pairing evidently takes place. Adults lived for 14 days in captivity.

The degree of infestation by *A. pinivora* can be forecast by counting the larvae overwintering in the soil. In 1940, the maximum number of larvae found was about 500 per sq. yard; they were most abundant in the soil under trees that had suffered the more severe forms of damage, and it is estimated that the presence of about 84 larvae per sq. yard in the soil beneath the trees constitutes a danger to the stand.

The parasites of *A. pinivora* observed in 1940 comprised the Ichneumonid, *Xenoschesis fulvipes*, Grav., which was abundant, and the Tachinid, *Pseudopachystylum goniaeoides*, Zett., puparia of which were found in the soil near dead larvae. The larvae of the Tachinid, which has one generation a year, develop in those of the sawfly and emerge from them in early spring to pupate in the soil. Some control was afforded by the small form of *Formica rufa rufo-pratensis*, Forel [*cf. R.A.E.*, A **35** 212], and mass breeding of this ant is recommended.

The control measures suggested comprise liberal applications of a contact insecticide against larvae in the first three instars and a stomach poison against older ones; the use of a rotary cultivator against pupae; and the introduction of poultry or pigs into small areas, poultry being of most value when the adults emerge from the ground.

Niklas (O.-F.). **Zur Lebensweise der kleinen Fichtenblattwespe** *Lygaeonematus abietum* **Htg. (=***Lyg. pini* **Retz.) in verschiedenen Bestandsformen des Forstamtes Eichwald, Ostpreussen.** [The Mode of Life of the small Spruce Sawfly *Pristophora abietina*, Christ, in various Types of Stand in the Forest District of Eichwald, East Prussia.]—*Z. angew. Ent.* **30** pt. 2 pp. 224–251, 8 figs., 16 refs. Berlin, 1943.

In view of increasingly severe damage to spruce in East Prussia by *Pristophora abietina*, Christ (*Lygaeonematus abietum*, Htg.), investigations on its bionomics and control were carried out in 1938–40 in a forest district near Insterburg, where it had been active since 1931. By the early spring of 1939, the damage had spread to spruce stands of all ages, and also to spruce in mixed stands. Cocoons were most abundant in the soil in stands of old spruce interspersed with a few deciduous trees, and least so in young spruce stands; this

variation in numbers rendered counts of cocoons somewhat unreliable for forecasting abundance. Of the insects in cocoons collected in late April or early May 1939, about 31–63 per cent. were dead, including about 27 per cent. parasitised, and 22–26 per cent. were in diapause. The parasites reared from them were *Microcryptus brachypterus*, Grav., a species of *Stylocryptus* thought to be *S. brevis*, Grav., *Polyblastus flavicauda*, Roman, *Mesoleius* sp. (possibly *M. dubius*, Hlmgr.) and *Erromenus* sp.

In 1939, adult emergence began in mid-May and continued for three weeks, and oviposition was in progress between 24th May and 25th June. Up to 14 eggs were laid in the needles on shoots about an inch long [*cf. R.A.E.*, A **25** 212], but only one per needle. Most eggs were laid on early spruces during the first half of the period, and on late spruces during the second half. Eggs were unusually abundant on young trees, despite the small numbers of cocoons found beneath them, so that migrations of the adults must be assumed. Owing to the long oviposition period, all stages of development from egg to full-fed larva occur together. Larval development appeared to be most rapid on the latest spruces, and slowest on the earliest ones, but there were considerable variations; descent to the soil began on 5th June. The greatest numbers of larvae were found on sample trees on 5th and 14th June; the high infestation figures for the second half of the development period indicated a heavy attack on late spruces.

Arsenical dust was applied from aircraft during June 1939 to over 3,200 acres in the infested district, and the treatment was repeated after ten days over nearly two-fifths of the area. Although all the larvae on the trees were apparently destroyed in the areas examined, even those stands that had received two treatments were severely attacked in the following year, possibly because many larvae had been in diapause in their cocoons or because adults migrated from areas that had received only one treatment. It is concluded that the dust should be applied to all infested areas, and that two applications should be made, the first about 14 days after the beginning of oviposition, and the second towards the end of the larval stage.

JAHN (E.). **Über das Auftreten von *Tortrix viridana* L. im Gebiet der Pollauer Berge und die Parasiten und Räuber dieses Schädlings.** [The Occurrence of *T. viridana* in the Region of the Pollau Mountains and the Parasites and Predators of this Pest.]—*Z. angew. Ent.* **30** pt. 2 pp. 252–262, 8 figs., 8 refs. Berlin, 1943.

An outbreak of *Tortrix viridana*, L., occurred in 1941 and 1942 in a number of forest districts of Austria and Czechoslovakia in the region of the Pollau mountains. In addition to oak, the larvae also attacked maple and elm, but not ash. Varying degrees of damage, amounting sometimes to total defoliation, were caused to the oak trees, of which stands 25 years old, standards over coppice and isolated older trees were the most severely attacked. *T. viridana* was accompanied by *Operophtera* (*Cheimatobia*) *brumata*, L., on oak in 1941 and 1942, and by *Erannis* (*Hibernia*) *defoliaria*, Cl., on oak and elm in 1942. At the end of May 1942, pupae of *T. viridana* were observed on all parts of the trees and in the undergrowth. Only 28 of the 3,000 pupae collected were parasitised, all by the Ichneumonid, *Itoplectis* (*Pimpla*) *maculator*, F., adults of which emerged between 11th and 18th June; adults of *T. viridana* had emerged from the healthy pupae between 7th and 11th June. Predators were numerous and included *Calosoma sycophanta*, L., *Panorpa communis*, L., and the Mirids, *Cyllecoris histrionicus*, L., and *Calocoris ochromelas*, Gmel., all of which were observed attacking the pupae, and *Cantharis rustica*, Fall., which attacked both larvae and pupae of *T. viridana*, as well as larvae of *O. brumata* and eggs of

various species. The literature on the habits of these and other insects observed in the forests is briefly reviewed.

BECKER (G.). **Beobachtungen und experimentelle Untersuchungen zur Kenntnis des Mulmbockkäfers** (*Ergates faber* **L.). 2. Die Larvenentwicklung.** [Observations and experimental Investigations on *E. faber*. 2. Larval Development.]—*Z. angew. Ent.* **30** pt. 2 pp. 263–296, 16 figs., 28 refs. Berlin, 1943.

This second part of a paper on the bionomics of *Ergates faber*, L. [*cf. R.A.E.*, A **30** 614] contains the detailed results of laboratory investigations on the development of the larvae of this Prionid in pine wood, some of which have already been noticed [**33** 18]. The larvae, which are described, are restricted to coniferous wood; on pine, they attack the sapwood, but not the heartwood or bark. The infested wood is generally attacked simultaneously by fungi, which cause its decay. Larval development in naturally infested wood lasts 3–6 years or more, but usually 4–5 years. In autumn, larvae in the upper parts of stumps make their way to the underground parts.

In the laboratory, development of the larvae was most rapid at 30–31°C. [86–87·8°F.] and temperatures between 24° and 32°C. [75·2° and 89·6°F.] were favourable; the upper limit, in wood containing about 25 per cent. of its weight of water, was just above 37°C. [98·6°F.]. Mortality was lower at fluctuating than at constant temperatures. The lowest limit of relative air humidity at which newly hatched larvae kept at constant temperatures of 20° and 28°C. [68 and 82·4°F.] could develop was 75–80 per cent., corresponding to wood containing about 14 per cent. water. As humidity increased, growth was accelerated and mortality decreased. The lowest limit of atmospheric humidity for older larvae was 90 per cent., corresponding to wood containing 20 per cent. water, and with increasing size they required wood containing 25–30 per cent. Growth was most rapid in wood containing about 60 per cent., and even wood containing 105 per cent. could be tolerated, although mortality was high. When sapwood of pine logs that had been felled a month before and stored in a moist condition was artificially infested with nine larvae and kept at 28°C. in a saturated atmosphere, the six individuals that survived increased their original weight by an average of 58 per cent. in 67 days.

Experiments on the nutritive value of the various zones of wood showed that the average weight of larvae in the outer sapwood was twice as great after about 40 weeks as in the inner zones, and three times as great as in the heartwood. It was not affected by the presence of oils or fats in the wood, but was increased by that of proteins and soluble carbohydrates. The influence of proteins on growth was not so marked as in the case of *Hylotrupes bajulus*, L. [*cf.* **33** 18–19], but young larvae fed on wood impregnated with 1 per cent. peptone and 0·2 per cent. glucose and kept at 28°C. and 96–98 per cent. relative humidity increased their weight by 64 per cent. in 70 days, whereas those fed on untreated wood gained only 19 per cent. in the same period. Fungi that attack dead wood appeared to have no particular influence on the development of very young larvae, but accelerated that of the older individuals and indeed appeared essential for rapid development. The four species tested were of different values in this respect, but *Poria contigua* was the most effective.

Natural enemies of *E. faber* recorded in the literature include the Ichneumonid parasite, *Xylonomus filiformis*, Grav., and predacious vertebrates; the author observed numerous larval and pupal skins of Asilids in association with dead larvae of *E. faber* and other insects.

In an appendix to the first part of the paper, it is stated that the pupal stage [*cf.* **30** 615] averaged 25–26 and 13 days at 20 and 28°C., respectively, while the prepupal stage lasted at least 13 and 7 days. Although a constant temperature of 28°C. appeared harmful to pupae collected in the field, larvae kept at that temperature gave rise to adults without ill effects.

Gösswald (K.). **Richtlinien zur Zucht von Termiten.** [Directions for the Rearing of Termites.]—*Z. angew. Ent.* **30** pt. 2 pp. 297–316, 19 figs., 16 refs. Berlin, 1943.

In view of the need for large numbers of termites for use in research on wood protection, a method of mass breeding in the laboratory was evolved by the author, whereby colonies of *Kalotermes* (*Calotermes*) *flavicollis*, F., were reared from young and older sexual forms and from supplementary reproductives. The technique, which is described in detail, involves the maintenance of the termites in an incubator at a temperature of about 27°C. [80·6°F.] in glass tubes or jars containing a layer of plaster of paris kept damp to ensure constant humidity ; the pieces of pine wood on which they are fed may be impregnated with diastase in water (1 : 20) to hasten development [*cf. R.A.E.*, A **27** 335].

d'Oliveira (M. de L.) & Vieira Borges (M. de L.). **Um parasita da** *Orobanche crenata* **Forsk.** [A Parasite of *O. crenata*.]—*Brotéria* **42** fasc. 2 pp. 95–96. Lisbon, 1946.

In the spring of 1943, seed capsules of *Orobanche crenata*, parasitising broad beans in Sacavém and Parêde and *Pelargonium* in Lisbon, were found to be infested by an unidentified Agromyzid. Although up to four larvae or pupae were found in some of the capsules, all the seeds were not destroyed, but it is thought that the insect might limit the spread of *Orobanche*, which causes considerable damage to broad beans in Portugal.

Baeta Neves (C. M.). **La** *Dioryctria splendidella* **H. S. (Lepidoptera-Pyralidae), espèce nouvelle pour l'entomofaune portugaise.**—*Bull. Soc. portug. Sci. nat.* **14** no. 17 pp. 65–69, 2 figs., 20 refs. Lisbon, 1943.

The Pyralid, *Dioryctria splendidella*, H.-S., was observed in Portugal for the first time in 1940, and again in 1941 and 1942, attacking *Pinus pinaster*. The larvae, mining beneath the bark, caused resinous nodules to form on the lower parts of the trunks of young trees in plantations and on one occasion at the base of a branch on a full-grown tree [*cf. R.A.E.*, A **19** 124, 125]. Several examples of *Cydia* (*Laspeyresia*) *coniferana*, Ratz., were also obtained from *P. pinaster*.

Silva (P.). **Esclarecimentos sobre** *Baryconus* **sp. (Hym. Scelionidae), parasita dos ovos do** *Oecanthus* **sp. (Orthop. Oecanthidae).** [An Elucidation of *Baryconus* sp., an Egg-parasite of *Oecanthus* sp.]—*Bol. Soc. brasil. Agron.* **7** no. 4 pp. 451–453, 9 refs. Rio de Janeiro, 1945.

In an abstract in this *Review* [A **10** 614], a Scelionid of the genus *Baryconus* was erroneously recorded as a parasite of the eggs of *Selenothrips* (*Heliothrips*) *rubrocinctus*, Giard, in Bahia, whereas it was, in fact, an egg parasite of one of two Orthoptera found on cacao there [*loc. cit.*]. Attention is drawn to this error, and reference is made to subsequent papers in which it has been repeated.

De Santis (L.). **El taladro de los eucaliptos** (*Phoracantha semipunctata* **Fabr.).** [The Eucalyptus Borer (*P. semipunctata*).]—*Ingen. agron.* **7** no. 3 pp. 127–138, 5 pls., 45 refs. Buenos Aires, 1945.

The author describes all stages of *Phoracantha semipunctata*, F., the larvae of which bore beneath the bark of *Eucalyptus* trees that are decadent or weakened, and discusses the systematic position, geographical distribution, bionomics and control of this Cerambycid, mainly from the literature [*cf. R.A.E.*, A **6** 325 ; **17** 245]. In Argentina, it occurs in the Provinces of Buenos Aires, La Pampa, San Luís, Córdoba and Entre Ríos, and is particularly harmful to *Eucalyptus*

globulus [**12** 156]. In La Pampa, pupation began in the first half of November, and adults emerged during December, January and February and laid their eggs soon after emergence. In La Plata, Province of Buenos Aires, the severity of the attack was partly attributed to the poverty of the soil and to the damage done to trees by the weevil, *Gonipterus gibberus*, Boisd. Two predators attacking *P. semipunctata* have been observed in Argentina, the Clerid, *Pelonium amoenum*, Guér., and the Trogositid, *Temnochila steinheili*, Rttr.

DE LA ROSA (E.). **Gallina ciega** (*Lachnosterna* o *Phyllophaga* **sp.).** [The White Grub (*Lachnosterna* or *Phyllophaga* sp.).]—*Fitófilo* **1** no. 1 pp. 21–25, 2 pls. San Jacinto, D.F., Mex., 1942.

The larvae of a species of *Lachnosterna* (*Phyllophaga*), which are briefly described, cause considerable damage in Mexico to the roots of various crops, including maize, strawberries and potatoes. The adults usually appear every three years, and injury is greatest in the season following a flight year. Measures that can be employed against the larvae and adult beetles of this genus are reviewed. If the soil is heavily infested, leguminous crops should be sown, as these are less susceptible to attack.

FERRER MENDIOLEA (E.). **Plagas de las coníferas.** [Pests of Conifers.]—*Fitófilo* **1** no. 2 pp. 3–30, 3 pls., 2 figs., 17 refs. San Jacinto, D.F., Mex., 1942.

A general account is given of the morphology and habits of Scolytids and Platypodids that attack forest trees, together with notes on their control by means of trap logs or repellents, and lists of Mexican species that do and do not attack conifers, showing their local distribution. Brief records are appended of a few other insects that infest conifers in that country.

SIEGLER (E. H.). **Susceptibility of hibernating Codling Moth Larvae to low Temperatures, and the Bound-water Content.**—*J. agric. Res.* **72** no. 10 pp. 329–340, 7 figs., 13 refs. Washington, D.C., 1946.

The following is almost entirely the author's summary. An account is given of investigations of the susceptibility of the hibernating larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., to low temperatures, as indicated by the temperature to which they can be undercooled before beginning to freeze, and of their bound-water content. Unlike some insects, *C. pomonella* cannot withstand more than one freezing, but the overwintering larva shows a pronounced tendency to undercool. The average undercooling temperatures for different groups of larvae ranged from −24·4°C. [−11·92°F.] to −30·1°C. [−22·18°F.]. The average rebound temperatures to which their temperatures rose after freezing began ranged from −5·0°C. [23°F.] to −11·2°C. [11·84°F.]. No marked differences in undercooling temperatures were shown by larvae collected from apple trees in Washington, Colorado, Arkansas, Maryland and Georgia or by the progeny of females from Georgia mated with males from Washington. The undercooling temperatures of the larvae were practically unaffected by sex or weight. A study of the effect of exposing larvae to dry and humid conditions indicated no marked changes in their undercooling temperatures. Undercooling is favoured by the quiescent state of the larva during the hibernation period, and artificial movement of the larva greatly reduced undercooling. The average bound-water content of the larvae was determined by two methods, which are described. It was 35·9 per cent. when determined by the dilatometric method at −7·5°C. [18·5°F.] and 11·2 per cent. when determined by the heat-of-fusion-of-ice method at −30°C. [−22°F.].

Hill (R. E.). **Influence of Food Plants on Fecundity, larval Development and Abundance of the Tuber Flea Beetle in Nebraska.**—*Res. Bull. Neb. agric. Exp. Sta.* no. 143, 16 pp., 2 figs., 24 refs. Lincoln, Neb., 1946.

Since the elimination of early potato crops, the destruction of self-sown potato plants and delayed planting of late crops are recommended in western Nebraska for the control of *Epitrix tuberis*, Gentner [*R.A.E.*, A **34** 28–29], laboratory and field studies were carried out in 1943–44 to determine the effects of various spring food-plants on the fecundity and length of life of the adults and the development of the larvae. The following is taken from the author's summary. All the food-plants tested were those upon which the overwintered beetles commonly feed in the spring. The type of food-plants consumed by caged flea-beetles markedly influenced oviposition and length of adult life. Potato foliage was the most satisfactory food, egg production being highest and mortality lowest on such a diet. On the same basis, tomato and wild tomato (*Solanum triflorum*) were also favourable adult foods. Buffalo bur (*S. rostratum*), although equally adequate for adult subsistence, proved inferior for egg production. Measured in terms of both oviposition and length of life, *Physalis lanceolata*, *Iva xanthifolia*, *Kochia scoparia* and field beans (*Phaseolus vulgaris*) were less satisfactory.

The substitution of potato foliage for less nutritious diets was followed in two or three days by increased egg production, and a change from potato to the foliage of other food-plants resulted in decreased egg production. In a test over a period of 60 days, significant fluctuations in egg deposition were recorded when diets of potato foliage and either *I. xanthifolia* or *S. rostratum* were alternated at ten-day intervals. In the field, larvae developed most readily and in largest numbers on potato roots and tubers. The average number that completed development on roots of tomato was less than a third of that on potato, only a few individuals matured on *Physalis lanceolata*, *S. nigrum*, *S. rostratum* and beans, and no larvae were observed to do so on *S. trifolium*, *I. xanthifolia* and *K. scoparia*. Egg viability was unaffected by type of food. There was some indication that the frequency of mating was influenced by the quality of food consumed by the beetles.

The largest populations of *E. tuberis* occur in localities where early planted potatoes are grown. The present study indicates that the elimination of all such early plantings would lower the general population level by reducing the reproductive capacity and length of life of the overwintered adults. In the absence of potatoes, these overwintered adults would be forced to feed, live and reproduce on less nutritious food-plants, thus greatly decreasing the number of first-generation beetles available to infest late-planted potato fields. Since western Nebraska is essentially a late potato crop area, the elimination of the relatively few acres of early planted potatoes should involve only minor adjustments in the general farming programme of a few individual potato growers.

Sheppard (R. W.). **Notes on the Occurrence of the Comstock Mealybug *Pseudococcus comstocki* (Kuw.), at Niagara Falls, Ontario.**—*Canad. Ent.* **77** no. 12 p. 217. Guelph, Ont., 1946.

Pseudococcus comstocki, Kuw., was observed in abundance on large *Catalpa* trees in Queen Victoria Park, Niagara Falls, Ontario, in September 1944 and was subsequently found to be distributed sporadically within a two-mile radius of this point. It was almost entirely confined to *Catalpa* spp., but a few adults were found on other trees and shrubs adjacent to and more or less overhung by infested *Catalpa*, and a few small egg clusters were attached to the base of the stems of *Magnolia* and privet. About 25 per cent. of the *Catalpa* trees in the area were attacked to a greater or less degree ; some old trees in the park that were 50 ft. or more high were infested for at least two-thirds of their

height. A few trees that were heavily attacked in 1944 were very lightly infested in 1945, whereas others were lightly infested in the former year and heavily in the latter. The adults were active from early August until November. The egg-masses are deposited under loose bark or within old scars on the trunks of large trees, but are more abundant in gall-like excrescences, which the mealybug may cause to develop and which occur chiefly on the lower surface of the lower branches. In general, the egg-masses are most abundant on the east and south sides of the trees. Eggs present in October 1944 did not hatch until the following August.

ARMSTRONG (T.). **Differences in the Life History of Codling Moth, *Carpocapsa pomonella* (L.), attacking Pear and Apple.**—*Canad. Ent.* **77** no. 12 pp. 231–233, 1 graph. Guelph, Ont., 1946.

Experiments on the control of *Cydia* (*Carpocapsa*) *pomonella*, L., have been carried out for several years in a nine-acre orchard of old pear trees in the Niagara Peninsula. It is more or less isolated from other large orchards, and it was observed that hardly any of the fruits in it became infested until August. The damage then increased rapidly until harvesting began in late August or early September. In apple orchards in the same district, infested fruits were first recorded during the second or third weeks in June in 1941–1944, inclusive, and peak infestation was reached between 4th and 17th July. In 1943 and 1944, no infestation was recorded in the pears during June ; the percentages infested in 1943 were less than 1 at the end of July, 9 by 24th August and 14·4 by harvest. The distribution of the infestation in the pear orchard made it unlikely that it was due to first-generation adults migrating from a small apple orchard nearby, and the possibility that its lateness was due to delayed emergence of adults of the overwintered generation that had developed on the pear trees was accordingly investigated in 1944–45. The number of pupal skins on the trunks of twelve mature pear trees was counted every 2–4 days in 1944. Emergence continued from 29th May until 29th August, but only 14·8 per cent. of all the moths that emerged had done so by 10th July as compared with 97·7 per cent. three weeks later, whereas moths reared in the laboratory from larvae collected in an apple orchard all emerged between 6th June and 17th July. Larvae that were collected from pear and apple and became full grown between 23rd August and 21st September 1944 were kept in the laboratory until they gave rise to moths in 1935. Emergence of the apple moths began, reached a peak, and ended about 10, 21 and 7 days earlier, respectively, than that of the pear moths ; 90·3 per cent. of the former and only 26·8 per cent. of the latter had emerged by 17th July.

It has been observed that larvae of *C. pomonella* in other pear orchards experience great difficulty in entering immature fruits, and it is suggested that in the one under consideration the failure of many early larvae to survive over a number of years has resulted in the development of a strain with one generation a year in which the emergence of the adults is delayed and the larvae consequently appear when the fruits are softer and more easily penetrated. Any early larva that entered through the calyx would have been killed by lead arsenate sprays, which were regularly applied. Extensive hybridisation with the normal strain has not taken place owing to the absence of large apple orchards in the vicinity.

PAPERS NOTICED BY TITLE ONLY.

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WINTERINGHAM (F. P. W.). **Method for the Micro-determination of the Sorption of Fumigants.**—*J. Soc. chem. Ind.* **65** pp. 48–51, 1 fig., 11 refs. London, 1946. [*Cf. R.A.E.*, A **33** 264.]

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